Aviation Week

Including Space Technology

July 7, 1958

Vertol Unveils 107 Turbine Helicopter

North American Sabreliner

PAGES FROM AN ENGINEER'S WORKBOOK

Requirement:

Optimum wheels for long-range version of our newest aircraft

Details:

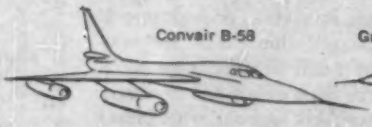
Must have good roll life - best obtainable load/weight ratio. no weight penalty.

Solution:

Goodyear Forged Wheels

Available in either magnesium or aluminum depending on specific requirements. Goodyear provides detailed advantages of each regarding weight and cost vs. performance-

AIRCRAFT NOW USING THEM:



plus—Grumman F9F-8T, and F9F-8, North American FJ-4, Douglas F4D-1 and DC-8, Chance Vought F8U-1 and F7U-3, McDonnell F3H-2, Convair CV-880, Lockheed L-1649, Viscount 812

THE SOUND ANSWERS COME FROM

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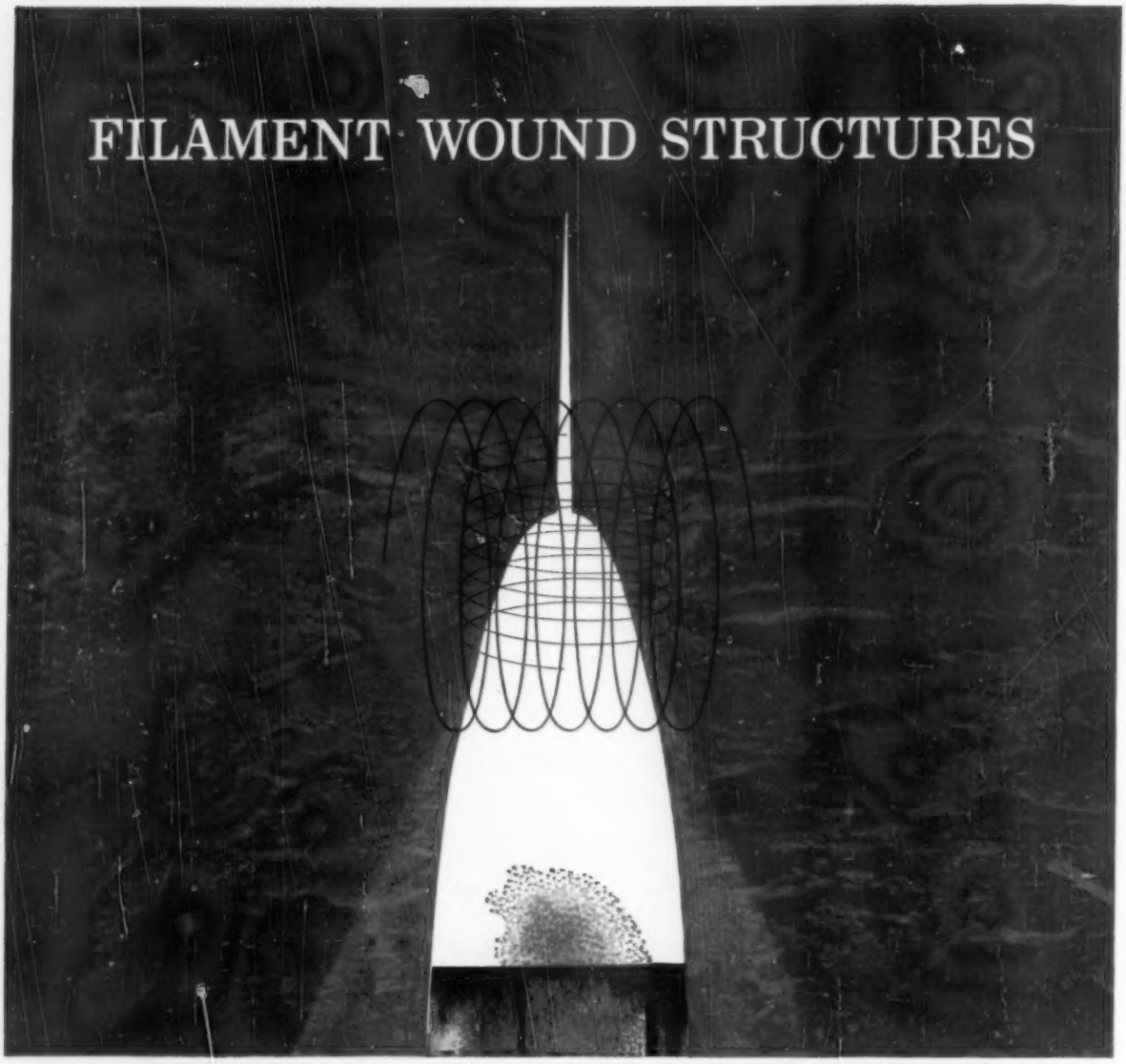
ADDRESS: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, Calif.



BRUNSWICK CREATES TOOLS FOR THE CONQUEST OF SPACE

Today rocket and missile men are calling for nose cones with strength and stiffness values that were unheard of only yesterday. And these must be produced within seemingly impossible minimums of weight and maximums of strength. Not to mention the dielectric and dimensional stability which must always be maintained to assure complete reliability.

Employing the super-secret Strickland "B" process, Brunswick research and development teams take these incredibly complex assignments as a matter of course. For they are past-masters wherever the technology of automated glass/resin structural components are concerned. They come up with truly practical answers—every time!

As in the past, these same skills are also available for solving your problems in design, fabrication and testing of aircraft components in metal honeycomb, conventional metalwork and reinforced plastics. For instant attention, write to: The Brunswick-Balke-Collender Company, Defense Products Div., 1700 Messler St., Muskegon, Mich.

BRUNSWICK

MAKES YOUR IDEAS *WORK*

AVIATION CALENDAR

July 20-Aug. 10—Canadian National Soaring Meet, Brantford, Ontario, Canada, American pilots invited.

July 21-Aug. 1—Advanced Feedback Control Theory, two-week Special Summer Program, Massachusetts Institute of Technology, Cambridge, Mass.

July 24-25—Quarterly Regional Meeting, Assn. of Local and Territorial Airlines, Denver, Colo.

July 24-25—Fifth Annual Symposium on Computers and Data Processing, Albany Hotel, Denver, Colo.

Aug. 5—Regional Technical Meeting on Space Exploration, sponsored by American Rocket Society and the Institute of the Aeronautical Sciences. For details: R. D. Linnell, General Chairman, Space Exploration Meeting, 3300 N. Harbor Drive, San Diego 1, Calif.

Aug. 6-8—Special Technical Conference on Non-Linear Magnetics and Magnetic Amplifiers, sponsored by the American Institute of Electrical Engineers, Hotel Statler, Los Angeles, Calif.

Aug. 7-8—Annual Conference, American Society for Quality Control, Western Region, El Cortez Hotel, San Diego, Calif.

Aug. 7-9—National Convention, OX5 Club of America, Hotel Statler, Los Angeles, Calif.

Aug. 7-15—Modern Developments in Heat Transfer, Continuation Course, University of Minnesota, Minneapolis, Minn.

Aug. 13-15—Conference on Electronic Standards and Measurements, National Bureau of Standards, Boulder Laboratories, Boulder, Colo. Sponsored by NBS, American Institute of Electrical Engineers and Institute of Radio Engineers.

Aug. 13-15—Seventh Annual Conference, Industrial Applications of X-ray Analysis, Albany Hotel, Denver, Colo.

(Continued on page 6)

AVIATION WEEK Including Space Technology

July 7, 1958
Vol. 69, No. 1

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Smaller than a dime, but a real buy if you're looking for top performance in airborne applications... that's the story on the Type 4-320 Pressure Pickup. This tiny member of CEC's reliable transducer family is built to operate at line pressures up to 350 psi... to measure differential pressures in ranges from ±7.5 psid to ±50 psid, and gage pressures in ranges from 7.5 to 50 psig ...and to meet all specifications *without external compensation* of any kind. Check these specs:

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Call your nearest CEC sales and service office for the details, or write for Bulletin CEC 1579-X7 (which is not only free, but extremely interesting).

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RECOGNIZED LEADERS IN GALVANOMETERS—
TELEMETRY, PRESSURE AND VIBRATION INSTRUMENTATION

HOW MAGNESIUM ALLOY SAND CASTINGS IMPROVE AIRCRAFT DESIGN

New thin-wall castings replace complex, costly fabrications

THE number of magnesium alloy sand castings used in aircraft and missile assemblies is growing by leaps and bounds. One reason is the general recognition among designers that magnesium saves precious weight without sacrificing strength and rigidity. Two other reasons are also responsible for the rapid increase in the use of magnesium castings in aircraft design:

1. New elevated-temperature alloys.
2. Simplified design, construction characteristics of magnesium sand castings.

THREE ALLOY SYSTEMS are now commonly used for magnesium sand castings — magnesium-aluminum-zinc, magnesium-rare earth and magnesium-thorium.

Mg-Al-Zn alloys have high strength and very good casting characteristics. They provide stability of properties up to 200°F. and often are satisfactory as high as 350°F. A number of different alloys in this system are available, each having a characteristic combination of properties — yield strength, pressure tightness, ductility, weldability, etc. In addition, these alloys are heat-treatable to obtain a range of strengths.

For the 350°F.-500°F. range, the magnesium-rare earth alloys can be used. These alloys have excellent pressure tightness as well as good creep strength at temperature and can also be heat-treated.

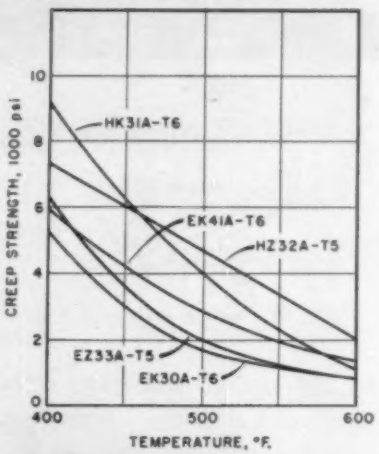
FOR TEMPERATURES UP TO 700°F., the magnesium-thorium alloys are used. HK31A is particularly good for short time elevated-temperature uses where high stresses are encountered. HZ32A is excellent for low stress performance over a long period of time. Both have creep characteristics superior to the Mg-Al-Zn and Mg-rare earth alloys, and both are available in the heat-treated condition.

Magnesium alloy sand castings are being made in a large variety of shapes and sizes, ranging from a few ounces to over 1600 lbs. The favorable casting characteristics of magnesium in general permit unusual flexibility in design.

THIN-WALLED SECTIONS, for example, can be produced to replace intricate fabrications involving several operations. Although thin walls are normally kept small in area, new techniques have been developed to obtain large thin-walled sections with better than average surface uniformity.

For more information about magnesium sand castings and their use in aircraft design, contact your nearest magnesium foundry or Dow sales office.

TYPICAL THIN-WALL magnesium casting used in a missile control surface.



CREEP STRENGTH of magnesium-rare earth and magnesium-thorium alloys—0.2% total extension for 1000 hours.

MAGNESIUM DESIGN, a 235-page handbook, discusses all phases in detail: properties, structural design, product design including castings and mill products, fabrication and finishing. Large section of tables on properties, sizes, tolerances, etc. For your copy contact a Dow sales office or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1451X.

YOU CAN DEPEND ON DOW

G.E. REDUCES PREMATURE BURNOUTS

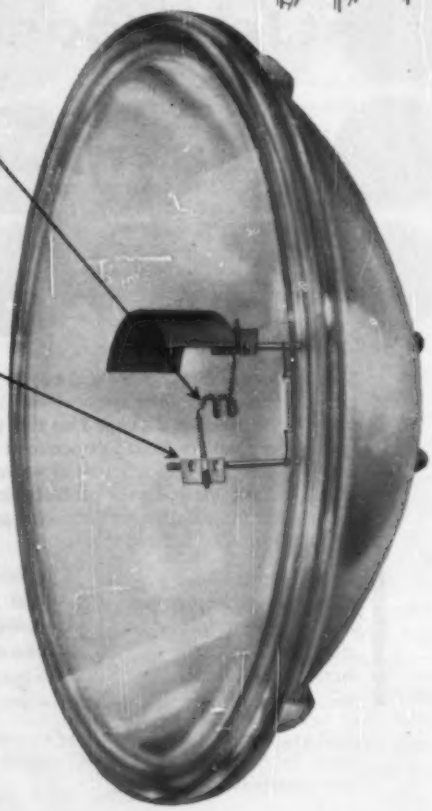
to cut down your landing lamp replacement costs.

Replacement charges for landing lamps are high. "Grounded" status because of burnouts is even more expensive—and aggravating.

General Electric has done two things to landing lamps to keep both these expenses to a minimum:

1 RUGGED COILED-COIL FILAMENT—needs no support wire to prevent sagging, eliminates premature failure caused by "sawing action" of support wire and filament.

2 METAL STRAPS—anchor each filament to a lead-in wire, insure constant beam aim.



Beam pattern is improved, too, because the compact filament is precisely designed and located to give a circular beam pattern of more even intensity. Yet G-E lamps cost no more—actually cost less in terms of longer burning hours in service.

Ask your G-E Lamp distributor about landing lamp 4559—or write: General Electric Co., Miniature Lamp Dept. AW-78, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

AVIATION CALENDAR

(*Continued from page 5*)

Aug. 17-23—Missiles Operations Research, Engineering Seminar, Pennsylvania State University, University Park, Pa.

Aug. 18-19—Annual Western Regional Meeting, American Astronautical Society, Dinkelspeil Auditorium, Stanford University, Palo Alto, Calif.

Aug. 19-22—Western Electronic Show & Convention, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.

Aug. 25-30—Ninth Annual Congress, International Astronautical Federation, Amsterdam, Holland.

Sept. 1-7—1958 Farnborough Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, Eng.

Sept. 2-12—Problems of High-Powered Radar Design, Summer Program, Massachusetts Institute of Technology, Cambridge, Mass. (Security clearance required.)

Sept. 3-5—1958 Cryogenic Engineering Conference, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 8-13—First International Congress of the Aeronautical Sciences, Palace Hotel, Madrid, Spain.

Sept. 9-11—Second National Conference on Applied Meteorology: Engineering, Ann Arbor, Mich. Program Chairman: Dr. D. J. Portman, 5500 East Engineering Bldg., University of Michigan, Ann Arbor, Mich.

Sept. 15-18—Fall Meeting, American Rocket Society, Inc., Hotel Statler, N. Y. C.

Sept. 15-19—Annual Instrument-Automation Conference & Exhibit (International), Instrument Society of America, Philadelphia Convention Hall, Philadelphia, Pa.

Sept. 22-24—1958 Meeting, Professional Group on Telemetry and Remote Control, Americana Hotel, Bal Harbor, Miami Beach, Fla.

Sept. 22-24—Seventh Annual Meeting, Standards Engineers Society, Benjamin Franklin Hotel, Philadelphia, Pa.

Sept. 25-27—Fifth Annual National Western Forum, American Helicopter Society, Ambassador Hotel, Los Angeles, Calif.

Sept. 29-Oct. 3—National Aeronautical Meeting, Society of Automotive Engineers, Inc., the Ambassador, Los Angeles.

Sept. 29-Oct. 3—Semi-Annual Meeting and Western Tool Show, American Society of Tool Engineers, Shrine Exposition Hall, Los Angeles, Calif.

Oct. 6-7—National Symposium on Extended Range and Space Transmission, sponsored by the Professional Groups on Antennas and Propagation and Communications Systems of the Institute of Radio Engineers and George Washington University, Lisner Auditorium, Washington, D. C.

Oct. 7-8—1958 Joint Meeting, Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, Chateau Laurier, Ottawa, Canada.

Oct. 22-24—Fifth National Vacuum Symposium, Sir Francis Drake Hotel, San Francisco, Calif.

Oct. 27—14th Annual General Meeting of the International Air Transport Assn., New Delhi, India.

Oct. 27-28—East Coast Conference on Aeronautical & Navigational Electronics, Institute of Radio Engineers, Lord Baltimore Hotel, Baltimore, Md.

SUNDSTRAND HYDRAULIC MOTOR POWERS CABIN PRESSURIZATION DRIVE

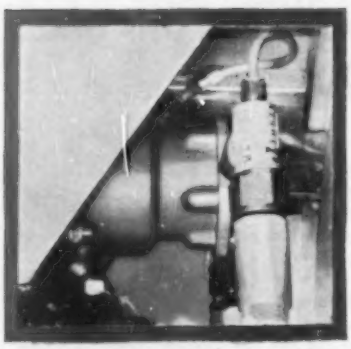


Photo Sundstrand Model MC046-525 fixed-displacement hydraulic motor used on Alti-Cruiser. One of a standard line offering from .030 to 5.25 cu-in displacement per revolution; 14.3 to 2,506 theoretical in-lb torque at 3000 psi; 2.72 to 191 theoretical horsepower from 3000 psi and rated speed. Ask for Bulletin 124.

Aero Design and Engineering Co. has selected, on a basis of comparative performance, a standard Sundstrand Aviation hydraulic motor to power the cabin pressurization drive of its new Alti-Cruiser.

Sundstrand aircraft hydraulic motors provide long life at continuous duty, high horsepower to weight ratio, high overload capacity, and high operating speed. These characteristics, combined with a wide selection of displacements, assure the right motor for powering a broad range of aircraft equipment.

Other features include few component parts, small envelope, continuous operation of 3000 psi at rated speeds, high overload capacity to 5000 psi on intermittent loads, and high torque to inertia ratios for rapid cycling or rapid reversing.

For complete information on Sundstrand hydraulic pumps, motors and constant speed drives for civilian and military aircraft, write today outlining your requirements.

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THE ELECTRICAL CONNECTOR THAT "WASN'T FOR SALE" BECAME A MAJOR PRODUCT

This is a success story in the true American tradition. It started during World War II. Engineers here at Scintilla Division of Bendix Aviation Corporation had a problem. The supply of electrical connectors for the aircraft ignition systems we were building was irregular and undependable. Nor were we satisfied with the performance when we *could* get them.

Our engineers set out to design the finest electrical connectors available anywhere. We produced them and used them solely as component parts in our own systems throughout the war. Then, we decided to make them available to anyone in industry who could use them.

In the ensuing years the electrical connector became a major part of our business. The tremendous demand for this product has resulted in the largest plant expansion in our history, to be devoted to the production of more and better electrical connectors.

We are grateful for the recognition of quality which is implicit in your acceptance of Bendix electrical connectors. We are happy to assure you that, while our new facilities will mean even larger connector production in the future, we shall continue to place greater emphasis on quality than on quantity.

We hope you are already familiar with Bendix electrical connectors. If you're not, may we offer our assistance in solving any connector problem.

SCINTILLA DIVISION OF BENDIX AVIATION CORP., SIDNEY, N. Y.

Canadian Affiliate: Aviation Electric Ltd., 200 Laurentien Blvd., Montreal 9, Quebec

A few of many types and sizes of standard and special Bendix electrical connectors. Our engineers are ready to aid you with the most exacting connector requirements.

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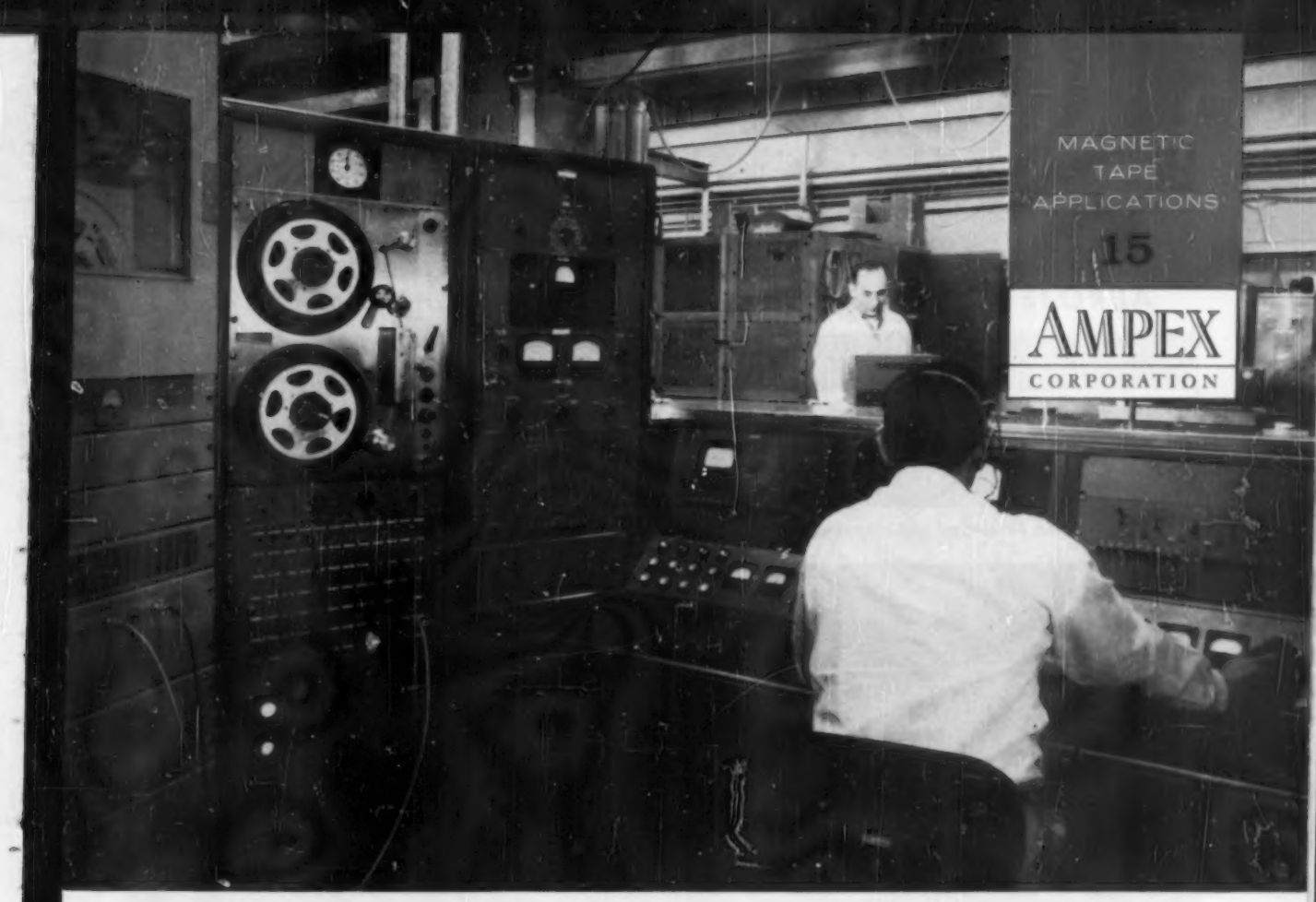
Scintilla Division
SIDNEY, NEW YORK

Bendix
AVIATION CORPORATION



How to improve component reliability by better shake tests

Magnetic tape simplifies complex-wave testing and lessens human error

Many of the components that got their first ride on this tape-driven shaker are now circling the sky in Explorer I, our first successful earth satellite. It is highly significant that the California Institute of Technology Jet Propulsion Laboratory which led the development work on this satellite also pioneered complex-wave vibration testing. In this technique, magnetic recording plays many vital roles.

THE WAY TO OUTGUESS THE UNKNOWNS

Is simple sine-wave vibration testing sufficient? Or is a closer simulation of the missile's actual vibration environment a necessity? Results are not the same. Sinusoidal simplification often demands knowledge more complex than the complexities of a realistic test itself. Rocket components can bear neither the weight of excess safety factors nor the risks of conjecture – reasons why JPL chose random noise and complex waves.

Telemetered vibration tapes from actual missile flights are often used on shakers to assist development of test procedures. But this is not a complete answer. Different flights yield different vibration environments. A more ideal test-programming tape is a synthesized composite or envelope of the more severe conditions from many flights. This tape often combines random noise of engine vibration and complex waves from aerodynamic properties and structural resonances. And just as the missile's mass, velocity and surrounding atmosphere will change rapidly with time – so the taped program must change too.

Once on magnetic tape, any test program stays intact. It is repeatable without tedious setup and time-varying control of separate signal sources. With a properly calibrated tape, there is little chance that an operator will accidentally create destructive forces by errors in frequency or gain settings. Tape eliminates many possible sources of human error. It also leaves personnel free to concentrate on other requirements of shaker operation and test observation.

TAPE PASSES ALONG THE "IDEAL" TEST

So that co-contractors and subcontractors will run desired shake tests correctly on the components they furnish, Caltech's JPL frequently sends them program tapes. These contain calibration data in addition to the program itself. Thus a similar shake-table setup on the other side of the country can exactly duplicate the tests run in JPL's own laboratory. The tape lessens chance of misinterpretations and additive safety factors.

As quantity production of missile components gets under way, magnetic tape offers a means to run optimum shake tests on large numbers of components at widely separated manufacturers. From copy tapes, test programs of complex waves can be run almost as easily as a simple sinusoidal scan. Individual users need not have equipment to generate their own shaker-control programs. Prime contractor or research co-contractor can furnish the tapes. And since any number of duplicates can be made, a well-conceived test program can have unlimited circulation.

May we send you our 16-page brochure on magnetic-tape instrumentation plus further information on the use of tape for vibration testing? Write Dept.

AMPEX INSTRUMENTATION DIVISION • 860 CHARTER STREET • REDWOOD CITY, CALIFORNIA
Phone your Ampex data specialist for personal attention to your recording needs. Offices serve U. S. A. and Canada. Engineering representatives cover the free world.

AEROJET for rocket power: the Navy's Polaris

The powerplant for the submarine-fired POLARIS will be an Aerojet solid-propellant rocket engine developed and manufactured at our Solid Rocket Plant near Sacramento.

AEROJET-GENERAL CORP.

THE GENERAL TIRE

A SUBSIDIARY OF THE GENERAL TIRE & RUBBER COMPANY

Engineers, scientists—investigate outstanding opportunities at Aerojet. (Plants at Azusa and near Sacramento, Calif.)

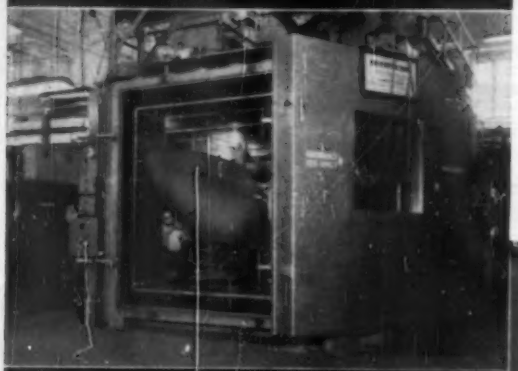
ENVIRONMENTAL TESTING & ANALYSIS

to foretell the performance of your products under actual service conditions

The personnel and facilities of Bell Aircraft Corporation's General Engineering Laboratories are now available to you in testing and analyzing the performance of materials, components, systems and packaging under environmental conditions duplicating those which will be encountered in actual use. Years of operational behavior frequently can be simulated in hours in the laboratory.

Extensive and diversified experience in such fields as automation, electronics, nuclear physics, servo systems, guided missiles, rocketry and aircraft eminently qualifies Bell engineers to handle your most exacting assignments quickly and competently. Qualified Product List (QPL) testing and Military Certification of tests are available. All equipment used complies with the requirements of MIL-E-5272A.

HI-CAPACITY CENTRIFUGE Capable of handling 500 pound objects subjected to 125 g's constant acceleration.



ALTITUDE CHAMBER Capable of maintaining altitudes up to 100,000 feet; Temperatures from —100° F to +200° F; Humidity to 98%; Physical Size 10' x 10' x 7'.

SALT SPRAY TEST CHAMBER Capable of temperatures from 80° F to 125° F; Humidity to 100%; Specimen capacity up to 159 cubic feet.

EXPLOSION CHAMBER Capable of temperatures from 68° F to 125° F; Altitudes to 50,000 feet; Capacity 5' dia. x 7'.

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VIBRATION • TEMPERATURE • ALTITUDE
HUMIDITY • SAND AND DUST • EXPLOSION
FUNGUS • SALT SPRAY • SUNSHINE • RAIN

Additional information and a copy of Bulletin EL-1, "Environmental Test & Analysis", can be obtained by contacting Sales Manager, Special Weapons Division, Zone B28A, **BELL AIRCRAFT CORPORATION**, Post Office Box One, Buffalo 5, N. Y.

BELL Aircraft Corp.
Special Weapons Division
BUFFALO, N. Y.

SAGE SETS AN ELECTRONIC "BEAR TRAP"

BURROUGHS ELECTRONIC DATA PROCESSING EQUIPMENT STANDS WATCH FOR OUR CONTINENTAL AIR DEFENSE.

Problems of the awesome speeds and scope that confront our military defense systems can only be solved by the quick and uncanny accuracies of electronic computation, such as is found in our Semi-Automatic Ground Environment—SAGE, which is now becoming operational! As a result Burroughs radar data-processing equipment fills important posts all along our peripheral continental approaches.

This major U. S. Air Force contract is one example of the widespread confidence in Burroughs Corporation's 70-year background of reliability and capability. It demonstrates Burroughs' new breadth in the development of electronic equipment and its continuing competence from research to final installation.

Burroughs Corporation

"NEW DIMENSIONS / in electronics and data processing systems"

NEW ICEFOIL

Meets requirements of MIL-D-8181 plus 2000 cps @ 15G Vibration Test plus 1450 ft.-lb. Ice-Ball Impact Test

The new Aeroproducts ICEFOIL is specially designed for installation in the intake duct of gas turbine engines. Combining simplicity of design with minimum weight and maximum strength, the ICEFOIL offers a truly modern ice detection system for jet-age military and commercial aircraft.

Its standard NACA airfoil shape cuts drag and air turbulence to a minimum. Its positive/positive pressure system provides a built-in fail-safe feature – gives longer life with greater reliability. Requiring no periodic calibration or adjustment, ICEFOIL presents ice warning in the cockpit or automatically activates de-icing systems at speeds from 50 to 550 knots.

Currently in production for the Douglas DC-8 commercial jet transport, ICEFOIL is available for immediate applications on engines, airframes, missiles and rockets.

Building for today...Designing for tomorrow

Aeroproducts

ALLISON DIVISION OF GENERAL MOTORS
DAYTON, OHIO

BIG EXTRUSIONS

...from Harvey Aluminum

improve design

reduce weight

lower assembly costs

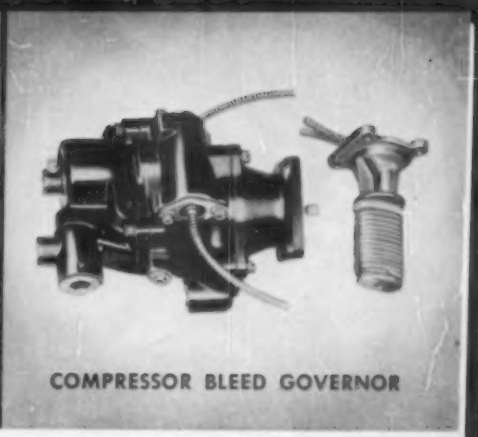
BIG QUALITY EXTRUSIONS — 3 feet wide and wider, as long as 80 feet — are being made by Harvey Aluminum. For information on BIG aluminum extrusions, and smaller shapes, too, write direct to Harvey Aluminum, Torrance, Calif., or contact the nearest Harvey Aluminum factory branch listed under "Aluminum" in your classified directory.

A major independent producer of quality aluminum in all alloys and sizes: Pig, ingot, billet, rod and bar, pipe, tube, hollow sections, press forgings, forging stock, hand forgings, impact extrusions, electrical bus bar, structurals, special shapes, light and heavy press extrusions, screw machine and other aluminum products. Similar products in titanium, zirconium, and steel. HARVEY ALUMINUM SALES, INC., Torrance, California.

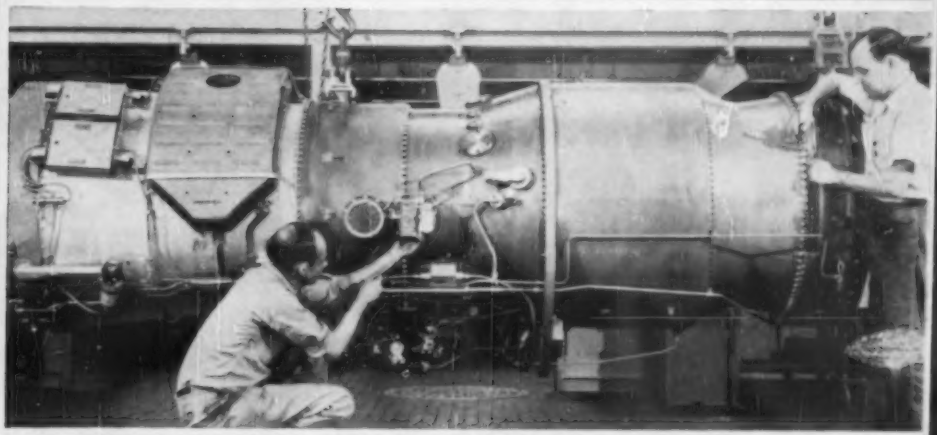
HARVEY Aluminum

Holley engine controls selected for JT4 engines on America's first jet airliner

BLEED PISTON ACTUATOR



COMPRESSOR BLEED GOVERNOR



Powered by four JT4 Pratt & Whitney Aircraft engines, the Boeing 707-320 will carry 131 first class passengers from New York non-stop to the Continent in just over six hours! Each of these new engines, commercial counterparts to the J-75 which drives many of America's latest jet fighters, delivers up to 15,000 pounds of thrust. Ability to pack so much added power into a relatively small space is the result of designing engine components which will operate at higher efficiency, require less area and reduce over-all weight.

Holley Carburetor Company, working closely with Pratt & Whitney Aircraft engineers, carried out this exacting assignment on such vital engine components as: the compressor bleed governor, and the bleed governor actuator. For single and multi-engine military aircraft, the Holley main fuel control is a companion unit to the Holley governor and actuator.

For military applications, the Holley main fuel control (right) is a companion unit to the governor and actuator.

HOLLEY Carburetor Co.

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Leader in the Design, Development and Manufacture of Aviation Fuel Metering Devices

HOW MODERN **T58** *POWERPLANT HELPS PROVIDE . . .*

700 Lbs More Payload Capacity

NEW SIKORSKY S-62 COMBINES PROVEN HELICOPTER COMPONENTS WITH PROVEN GENERAL ELECTRIC T58 TURBOSHAFT ENGINE

Sikorsky's newest helicopter combines the components of its famous S-55—proven in 1,000,000 flight hours—with modern General Electric gas turbine power, supplied by the compact, high performance T58. The result: a helicopter that provides 700 lbs more payload capacity . . . and more cabin space to carry it in . . . than the S-55.

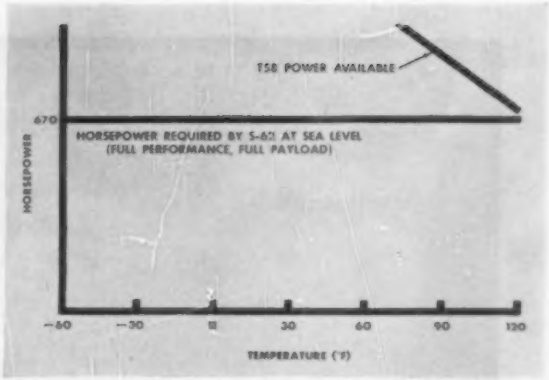
Capable of operating from either water or land, the S-62 is a highly versatile helicopter. Powered by a single T58, the S-62 will be qualified to perform a wide variety of missions. It will provide . . .

. . . *instantaneous flight capability*. Today's helicopters require about five minutes warm-up time. The T58 turboshaft requires *no* warm-up.

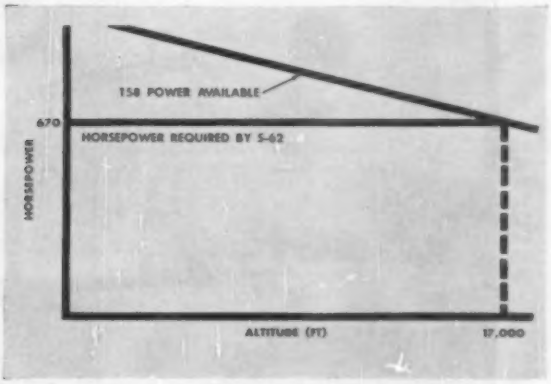
. . . *more power for hot weather flight*. From its single T58, the S-62 will have substantially more horsepower than the S-55, especially for high altitude or hot weather flight.

. . . *unequalled hovering ability*. The T58 will provide the full power required by the S-62 up to 17,000 feet.

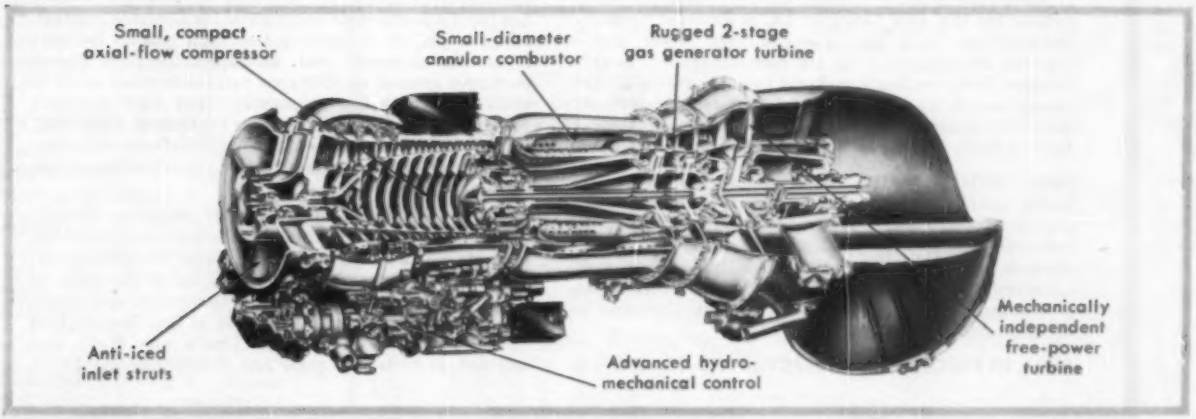
The S-62 is another striking example of the performance helicopters can get with the modern T58 turboshaft—the engine which provides more horsepower per pound of weight than any other shaft engine flying today. For new T58 technical information brochure, write to: General Electric Co., Section 233-16, Schenectady 5, N. Y.



Regardless of temperature, T58 will automatically provide S-62 the total horsepower it requires at sea level for full performance, full payload. In addition, operating the T58 at less than top design horsepower increases engine life.



At altitudes up to 17,000 feet, T58 will supply full horsepower requirement of S-62 . . . help insure unequalled hovering ability. This outstanding altitude and hot day performance is possible with an engine having a level of performance offered only by the T58.



General Electric production T58 delivers 1050 shp, weighs only 271 lbs without 75-lb optional reduction gear. Its near 4 to 1 power-to-weight ratio, 0.64 SFC give added insurance of top helicopter performance.

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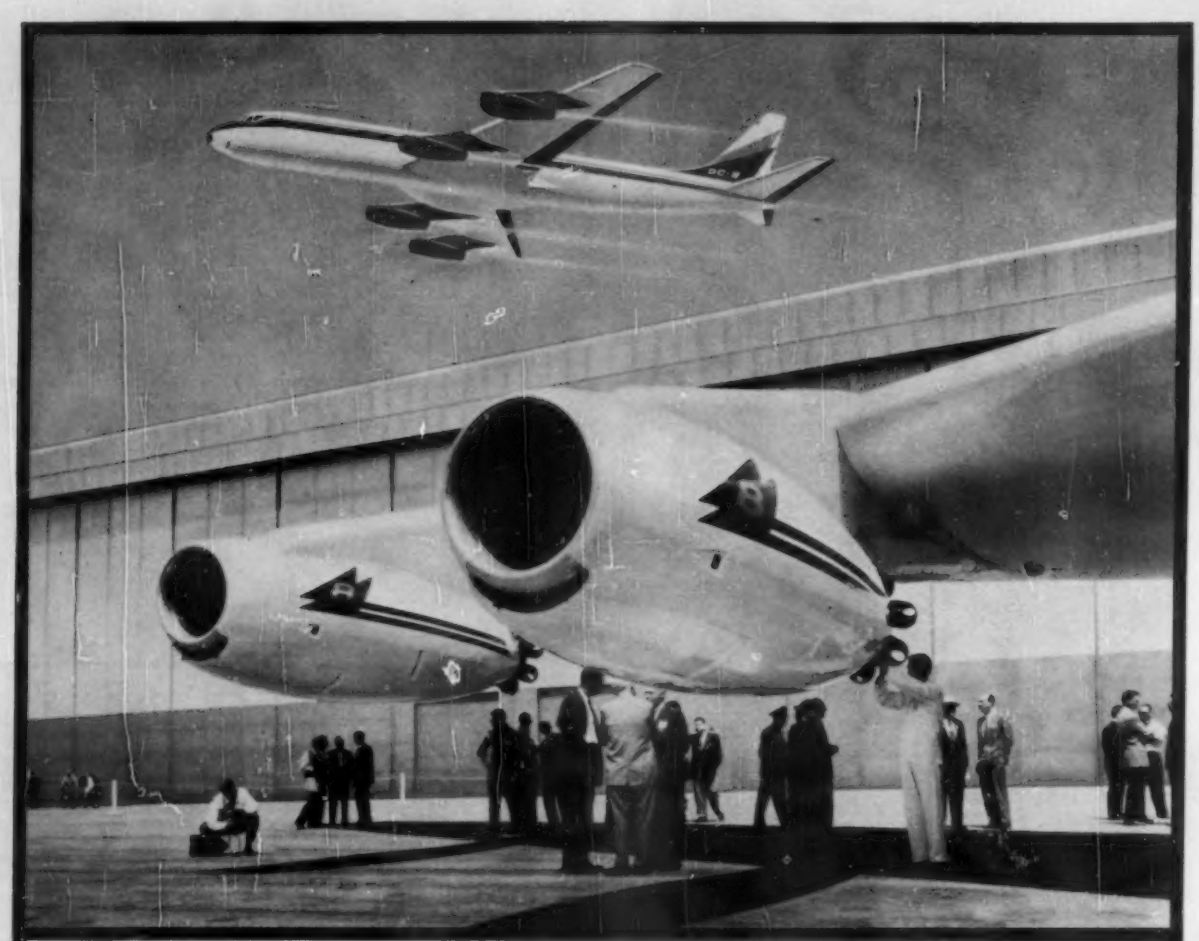

WHY RYAN WAS SELECTED TO BUILD THE JET PODS AND PYLONS FOR THE DC-8

It takes special skills to build the jet engine pods and pylons for the new Douglas DC-8 Jetliner. Quickly demountable, each pod is a complete power unit—capable of operating on its own—interchangeable between Jetliners. Each pod and pylon contains a huge jet engine, all controls, accessories, systems to serve it, and 3500 precision-made Ryan components. Almost half of them are made of hard-to-fabricate titanium.

SKILL WITH TITANIUM. As a pioneer in developing better methods for forming, welding, and machining titanium, since 1951, Ryan is ideally equipped to fabricate the nearly 7000 titanium pod and pylon parts for each DC-8 aircraft. Much lighter than steel ... many times stronger and more heat-resistant than aluminum ... titanium brings substantial benefits to the Douglas Jetliner.

SKILL IN PRECISION MANUFACTURING. The DC-8 is the finest example of the precision workmanship which has built a world-wide reputation for Douglas aircraft. Ryan is skilled in meeting this high quality because Ryan has designed and developed complete power packages around six different turbine engines prior to the DC-8. Ryan has consistently met high precision requirements of all major engine builders in producing thousands of jet engine structures, afterburners, rocket motors, ramjets and high temperature exhaust systems, for many years.

SKILL WITH ENGINEERING. Ryan is unique as the *only* firm specializing in building aviation power plant components which also designs, builds and flies jet aircraft. In this unique position, Ryan can merge the skills of metallurgists, engineers, pilots, designers, and stress analysts with production experts in building highest quality jet pods and pylons. That's why Ryan was selected to build the pods and pylons for the DC-8.

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July 7, 1958

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COVER: North American Aviation prototype UTX Sabreliner four passenger utility jet transport will be powered by two General Electric J85 turbines producing about 2,000 lb. thrust each. Each wing has five slats. Nose spike is VOR antenna. The airplane will fly later this year when the engines are delivered.

PICTURE CREDITS:
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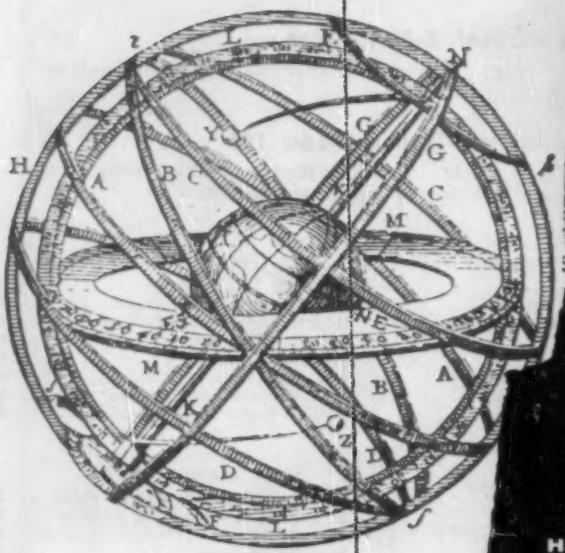

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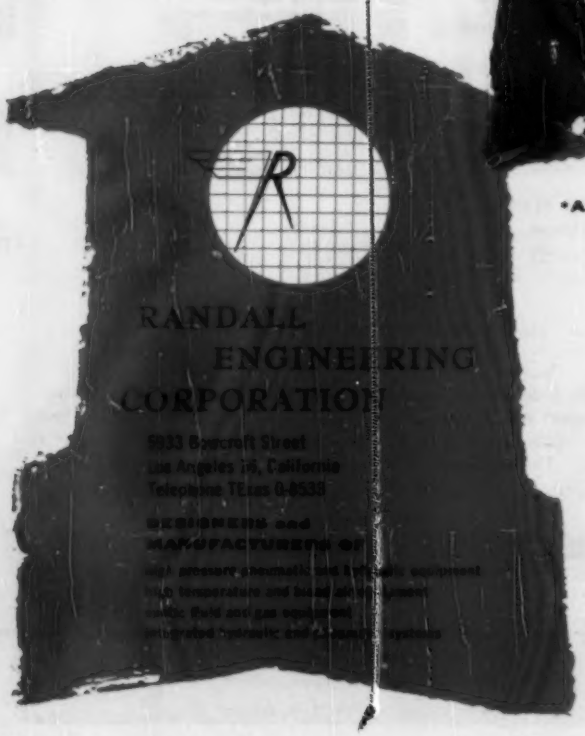

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EDITORIAL

USAFE's Mercy Missions

During our recent swing through Europe visiting NATO air forces we were impressed with how much genuine good will and mutual respect is being generated among Europeans by American military personnel with spontaneous and relatively low cost operations in contrast to the results produced by some of our formal and expensive aid programs. This type of activity may range from nothing more than loaning a local community a bulldozer to level a soccer field or provide a band for a local festival to the large scale mercy missions operated by United States Air Forces in Europe and flown by the 322nd Air Division (combat cargo). We had heard snatches of this mercy mission story in many parts of Europe so we journeyed 50 miles northwest of Paris where the 322nd headquarters at Evreux Air Base nestled in the rolling hills of Normandy, to get the whole story from its current commander Col. Clyde Box and his staff. The 322nd now has one of its two wings completely equipped with Lockheed C-130 Hercules turboprop transports. But most of the mercy missions that have made such a lasting impression in Europe have been those flown with the Fairchild C-119 and the Douglas C-124.

Last year when the worst locust plague in North African history began devastating crops in Tunisia the 322nd airlifted 400,000 lb. of insecticide in three days from Morocco to supply crop dusting aircraft, helicopters and hand operated dusting rigs fighting the pests. Shortly thereafter the locusts hit Morocco and the 322nd pitched in with another critical airlift of insecticide from Marseilles to the stricken area. The year 1956 was a rough one in Europe and the 322nd made major contributions in alleviating the disasters caused by man and nature. Early in that winter heavy snows isolated thousands of Greeks in the mountainous areas. In response to an appeal by the U.S. Ambassador to Greece, the C-119s of the 322nd parachuted more than 100,000 lb. of food and clothing to the snowbound villages. Later in February, 1956, the 322nd executed Operation Snowbound that carried some 700,000 lb. of food, clothing and blankets from German bases to Italians, Sicilians and Sardinians who had been cut off from normal food and fuel supplies by the worst snowstorms to hit these areas in 50 years.

Earthquakes rocked Lebanon in mid-March of 1956 and again the 322nd transports rushed blankets, tents and medical supplies to the afflicted area from Saudi Arabia and Morocco. In the fall of 1956 revolution rocked Hungary and the human debris from this valiant attempt to throw off the yoke of Soviet rule overflowed into Austria. A C-119 flew an iron lung and five tons of medical supplies from England to Vienna; and other transports rounded up bedding and mess gear for 5,000 persons from USAF bases in Wiesbaden, Chateauroux and Burtonwood. This gear was airlifted to Munich for rail shipment to Austrian refugee camps.

When fighting flared around the Suez canal the 322nd provided emergency evacuation for over 500 civilians to Athens and Rome and later airlifted nearly 1,500 United Nations troops and their supplies from Denmark, Norway, Sweden and Finland to the Naples staging area of the force that policed the Suez battle zone.

The 322nd Air Division and other USAFE transport aircraft also provide an annual "Kinderlift" which for the past five years has transported German refugee and under-privileged children from Berlin to West Germany for vacations in the country. This "Kinderlift" is operated in cooperation with the German Red Cross and provides safe conduct for refugees from East Germany who could not travel safely by land through the Soviet occupied area of Germany. Last year 2,000 children were given round trips by air from Berlin. The 322nd also operates a medical air evacuation squadron that does emergency missions for American tourists stricken abroad flying them to the nearest hospitals that can handle their problems.

All of these activities of course provide excellent training for the 322nd air and ground crews and increase utilization of their transport aircraft. But they are also building a badly needed reservoir of European good will and respect with these spectacular and unselfish mercy missions.

Price of Progress

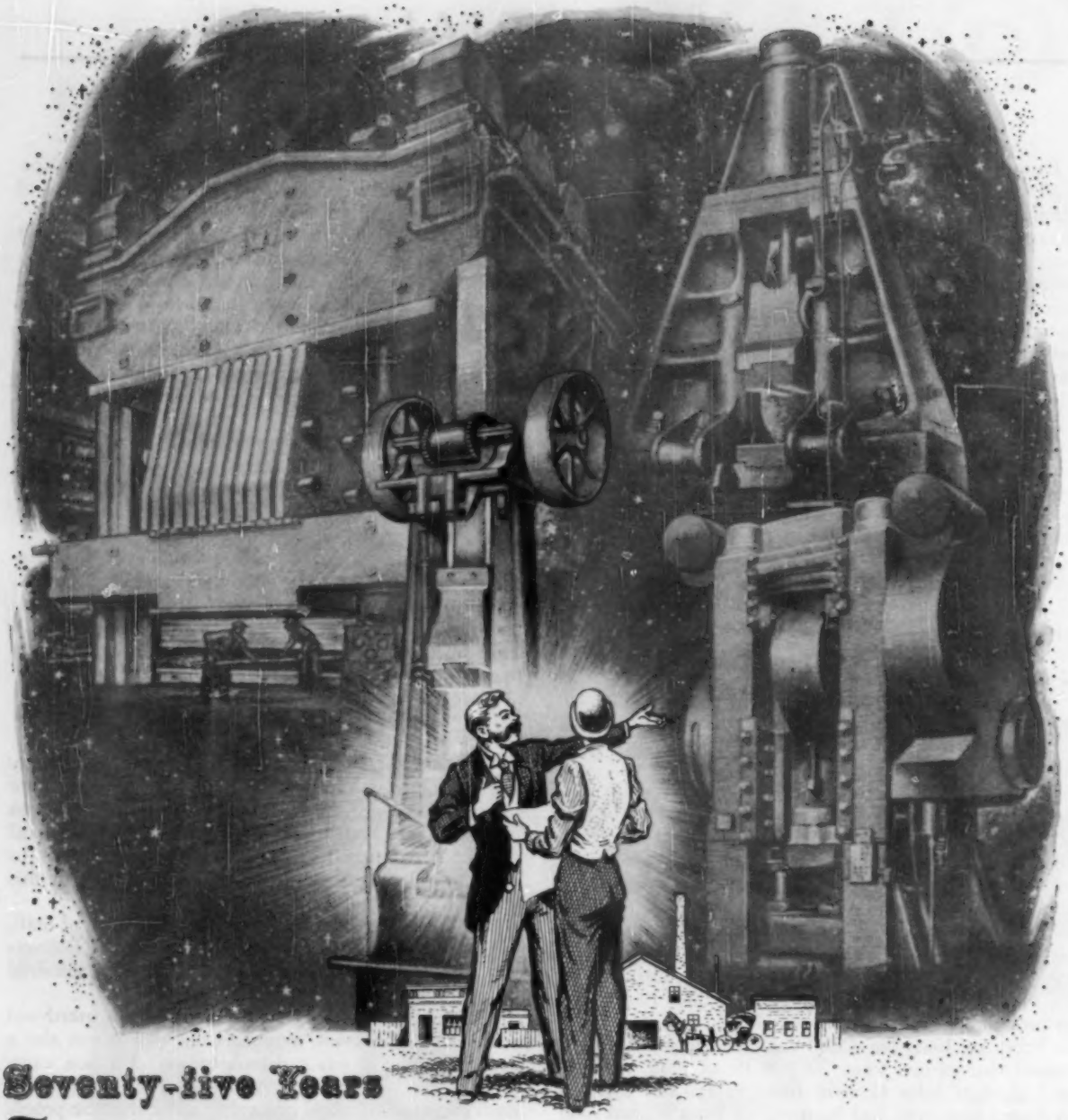
The crash of the Boeing KC-135 jet tanker shortly after takeoff from Westover AFB on an attempted record breaking run to England was one of those tragedies that inevitably punctuates the story of continuing technical progress. Aviation lost some devoted contributors to its technical progress and public understanding in this accident.

We think Gen. Thomas White, USAF Chief of Staff, expressed the thoughts of us who work in this business and who personally knew many of the men involved when he wrote:

"The mission on which these men had embarked was a routine one in every respect except that it was also a demonstration; it was a demonstration of a new capability of the United States Air Force as one of the principal guardians of world peace. In order that the people of the United States and of other nations may know and understand the steps by which we are diminishing the time and space that separate the nations of the Free World, we have often shared these notable experiences with men who are trained to observe and to report them. As we share with these men the conquest of time and space, they share with us the dangers of that conquest.

"This unfortunate accident serves as a reminder to all of us that the men who observe and report the achievements of science and skill that are so necessary to our survival, are partners in these achievements. They are also partners in the sacrifices that sometimes are the price of progress. The men who represent the world's need to know, and who in peace and in war share the dangers and the fate of our men in uniform, are equally worthy of the nation's gratitude."

—Robert Hotz



Seventy-five Years

THERE WAS a growing surplus in the United States Treasury—the Polygamy Act was passed—letter postage was reduced from three cents to two cents—the Brooklyn Bridge was opened—standard time was adopted—in 1883, when two young men, just graduated from Worcester Polytechnic Institute, established the business bearing their names—WYMAN-GORDON. The total capital was $27,000.

Integrity, initiative, ambition and ability were theirs. Endowed with these qualities and privileged to operate under that unique American system of free, private, competitive enterprise the Company prospered and grew.

On this our 75th anniversary, we salute the spirit of our founders and we pledge our every effort to help preserve, against the steady erosion of the last quarter century, that system which has made our nation what it is today and which has enabled us to build the greatest industrial production in the world, resulting in the highest standards for all segments of our people.

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WHO'S WHERE

In the Front Office

Leston Faneuf, board chairman, and **Harvey Gaylord**, senior vice president, Bell Aircraft Corp., Buffalo, N. Y. Mr. Faneuf continues as president of the company, and Mr. Gaylord continues as president of Bell Helicopter Corp., Ft. Worth, Tex.

Leon T. Eliel, board chairman, Fairchild Aerial Surveys, Inc., Los Angeles, Calif. **Brig. Gen. Edwin M. Day** (USAF, ret.) succeeds Mr. Eliel as president.

Henry M. Heyn, president, and **Robin A. Bell**, executive vice president, Surface Combustion Corp., Toledo, Ohio. Mr. Bell also elected president of the corporation's Janitrol Aircraft and Kathabar Manufacturing divisions, Columbus, Ohio.

Frank W. Crawford, executive vice president, Pacair, Inc., subsidiary of Pacific Airmotive Corp., Burbank, Calif.

John Tullis, executive vice president, Stratoflex, Inc., Ft. Worth, Tex.

Cyril E. McClellan, vice president-engineering, California Technical Industries, division of Textron, Inc., Belmont, Calif.

Martin F. Burke, vice president-industrial relations, United Aircraft Corp., East Hartford, Conn.

Max Bowen, vice president, Vertol Aircraft Co. (Canada), Ltd., Arnprior, Canada.

McLain B. Smith and **James W. Birkenstock**, vice presidents, International Business Machines Corp., New York, N. Y.

W. W. Harris, vice president-marketing, Roots-Connersville Blower, division of Dresser Industries, Inc., Connersville, Ind.

H. Gill Manifold, treasurer, Servomechanisms, Inc., Hawthorne, Calif.

Honors and Elections

The Royal Aeronautical Society, London, England, has elected the following as vice presidents of the Council for 1958-59; **Air Cmdre. F. R. Banks, Air Marshal Sir Owen Jones**, and **E. S. Moult. P. G. Masefield**, managing director of Bristol Aircraft, Ltd., has been elected president-elect of the Society for 1959-60.

J. Paul Walsh, Deputy Director of the Navy's Project Vanguard, has been awarded an honorary Doctor of Engineering degree by Stevens Institute of Technology "for his leading role in the development of missile technology."

Changes

Thomas Courtney, Jr., chief project engineer, Temco Aircraft Corp., Dallas, Tex.

Pratt & Whitney Aircraft, division of United Aircraft Corp., has announced the following changes: **Bernard A. Schmickrath**, engineering manager-engine division; **Willard L. Gorton**, assistant engineering manager; **Winfield D. Gove**, assistant to the engineering manager; **Richard T. Baseler**, chief engineer-production engines; **Richard J. Coar**, chief engineer-advanced projects (Florida facility); **Walter Doll**, assistant chief engineer-advanced projects (East Hartford facility); **C. T. McKinnie**, sales, manager-engines; **Bert J. McNamara**, manager-service and spare parts sales.

(*Continued on page 100*)

INDUSTRY OBSERVER

► Atlas intercontinental ballistic missile incorporates propellant utilization system which empties both tanks simultaneously so that when sustainer rocket burns out there is no dead weight remaining.

► **North American Aviation Missile Development Division's Dyna-Soar proposal envisioned unmanned test vehicle and final manned version. Special group from company's X-15 out-of-atmosphere rocket-aircraft project participated in formulation of proposal.**

► Miniature gas turbine-alternator unit weighing about 50 lb. is being used in conjunction with Army Ordnance's Martin SSM-A-12 Lacrosse surface-to-surface missile. Produced by Propulsion Research Corp. under Lear Inc. patent, turbine-alternator is carried on spotter's back to forward position and powers equipment for communication link to missile firing site. Martin has produced 1,000 Lacrosse missiles.

► **Award of nose cone contract for Ballistic Missile Division's Minuteman ICBM is scheduled to be made by end of this month. Proposals have been submitted by General Motors Corp., General Electric Co., Douglas Aircraft Co., Avco Research Laboratory, and Ford Motor Co., whose subsidiary, Aeronutronic Systems Inc., prepared Ford's submission in the bidding.**

► Nose cone of intermediate-range ballistic missile proved an even better radiator of infrared energy during re-entry than had been anticipated in recent tests on Army's Jupiter, strengthening the case for using infrared trackers in ballistic missile defense.

► **Next major Airways Modernization Board industry design competition will be for development of taxi routing and coordination equipment (TRACE) intended to speed flow and improve control of aircraft movements at the terminal. AMB briefing for bidders will be held July 8.**

► Republic Aviation is proposing a modification kit to convert all of its F-84E and F-84F models now in widespread NATO service to guided missiles with a zero rail launcher, a guidance system and provisions for both nuclear and conventional warheads.

► **Solid propellant producers are showing great deal of interest in ultra fine grade of aluminum powder being offered by National Research Corp. First evaluation by major rocket company reports favorably on material's potential as an energy boosting additive (AW June 23, p. 47). Compared to common powder sizes of 7 to 8 microns, dimensions of new globular material are guaranteed to be below 0.1 micron and are thought to be much smaller. Essentially straight aluminum, the new powder is not pyrophoric, has a density of 15 lb./cu. ft., and sells for $55/lb. in five-pound lots.**

► Ultrasonic method is being considered as effective means to solve difficult problem of determining cracks, discontinuities and other defects in solid propellant rocket motors for ballistic missiles.

► **Development study has started on small solid-propellant auxiliary power unit with rating equivalent to 10-15 hp. for hydraulic and electrical services in missiles, at Propulsion Research Corp., Curtiss-Wright subsidiary, Santa Monica, Calif., to produce substantially higher efficiencies than available with small high-speed turbines.**

► National Bureau of Standards plans to extend its research in high energy fuels to include ion propulsion. NBS now emphasizes free-radical studies.

► **North American Aviation is considering establishment of space physics laboratory in its missile development division, Downey, Calif., to strengthen its position in fast-growing field of space technology.**

► First Martin Titan ICBM to be delivered to Air Force's missile test center at Cape Canaveral will be facilities missile for general handling practice at site. Unit will be incomplete, probably will end up being cannibalized.

Washington Roundup

Bomb Powered Rocket

Propulsion through the use of a series of controlled nuclear explosions as suggested in a study by General Atomic Division of General Dynamics Corp. has been accepted and funded by the Advanced Research Projects Agency (see box, p. 30). A total of $1 million has been allocated for a continuation of the study during Fiscal 1959; further support of the project will depend on the results of this initial phase.

Very large increases in performance are theoretically possible if the explosive force of nuclear fuel can be effectively utilized rather than slowly using its heat energy as in present rocket propulsion schemes. Dr. Frederic de Hoffmann is directing the work which will be centered in San Diego.

Committee Rule Lessened

Department of Defense last week abolished 133 coordinating committees within the department. Officials said the reduction in committee strength is part of a move to accelerate the decision making process within DOD. An additional 94 committees have been continued to August 1, while further study determines their effectiveness. Another 72 committees are definitely being continued because, officials say, they are required by statute.

Prior to last week, 299 separate committees composed of representatives of two or more military departments plus civilian experts had a part in Department of Defense activity. The effectiveness of this arrangement was made clear in a Defense Department announcement which said, "Any functions, formerly performed by the 133 committees, that are essential, will be reassigned to the proper office or activity."

Space Delay

Staff members of both the House and Senate Space Committees are hopeful that a meeting of the Joint Conference Committee can be scheduled this week to put the final touches to legislation creating a National Space Agency. A meeting of conferees has been delayed because of the absence of Sen. Lyndon Johnson (D.-Tex), chairman of the Senate Space Committee.

Congress: Reliability Study

House Appropriations Subcommittee on Armed Services has begun an investigation of unreliability of military equipment to determine how bad the situation is; what Defense Department is doing to correct it. Investigation was spurred by recent appropriation hearings testimony, at the request of Rep. George Mahon (D.-Tex.). National Bureau of Standards and Arinc Research Corp. are assisting in the investigation.

Contract Changes

Legislation authorizing Defense Department to direct changes in research and production projects without first going through the time-consuming process of completing a new formal contract faces substantial opposition in Congress. Defense Department wants the authority on a permanent basis. Up to now, Congress has granted the authority on a year-to-year basis. The last authorization expired June 30.

In testimony to House Judiciary Committee urging enactment of the legislation, the Aircraft Industries Assn. explained: "To meet infrequent but important situations, we consider it essential that the Department of Defense be in a position to take appropriate action when a contractor has been requested to proceed with an urgent program of production, repair, or research. Quite understandably contractors will act more readily if they know that there is statutory authority for formalizing the commitments made.

"Likewise, in the complicated and sometimes hurry-up procurement which is necessary in these times, mutual mistakes are bound to occur. Thus, it seems to us to be clearly appropriate that the Department of Defense have the authority to correct expeditiously such mutual mistakes and any ambiguities which may arise."

Procurement Scrutiny

A move is developing in Congress to require congressional "authorization" of all military procurement programs. At present, only the appropriations to finance the programs are passed on by Congress. Under the new proposal, they would first have to be "authorized." This would bring four, instead of the present two, congressional committees into the picture: the House and Senate Armed Services Committees, as well as the two appropriations committees.

The proposal was put forth by Sen. Francis Case (R.-S. D.), a member of the Senate Armed Services Committee and author of the Renegotiation Act. Defense Secretary Neil McElroy promised a study of the proposal. At present, all public works programs and Navy's shipbuilding program require congressional "authorization."

Transportation Tax

Removal of the 10% transportation tax on passengers appears somewhat doubtful during this session of Congress, although Sen. George Smathers (D.-Fla.) has promised to wage a vigorous fight for repeal when technical amendments come up for consideration.

Repeal of the 3% transportation tax on freight, which both houses approved, had somewhat stronger backing than removal of the passenger tax. Railroads, strong supporters for repeal of transportation taxes, benefit more from removal of the freight tax than from elimination of the passenger tax, which would benefit airlines to a greater extent.

The Senate earlier approved amendments to the excise tax bill that would remove both the freight and passenger tax, but Senate-House conferees recommended removal of only the 3% freight tax.

Beverage Bill

There is little likelihood that Congress will take action on the many proposals to prohibit the sale of alcoholic beverages on aircraft before the current session ends. The transportation subcommittee of the Senate Commerce Committee held hearings earlier but recommended further hearings by the full committee. Thus far, no action has been taken. The House Commerce Committee has not yet held hearings, and chances are that none will be scheduled because of the press of other problems.

—Washington staff

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UNION CARBIDE TRADE-MARK SILICONES

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basis. The manufacturer is asking a lease rate of $21,000 per month per airplane on a three-year lease or $25,000 per month on a four-year lease.

One possible break in the soft DC-7 market may result from plans to repower the DC-7 with Napier Eland turboprop engines. The projected conversion is attracting serious attention within the airline industry and may open a new market for the long-range aircraft.

Medium Plane Market

Airlines feel that such medium-range aircraft as the Convair 240 series, the Martin 404, the DC-6B or the Viscount will not pose the same problems that long-range aircraft present.

They emphasize that the high cost of operation and maintenance coupled with an inflexibility of operation leave the latter group with a very limited market. As to cost of operation, total direct operating expense of the Convair 240 averages about 85 cents per plane mile compared to $1.60 for the DC-7B.

In addition to lower operating costs, the smaller aircraft are easier to operate and more versatile in performing a wide variety of airline and charter services. Range of price for used-planes in the medium-type, pressurized transport category remains fairly narrow year by year.

The Convair 240, for example, drew a typical price of $473,000 in 1952, climbed to $550,000 in 1954, and then leveled off in an area of approximately $490,000.

Lack of pressurization rules out the DC-4 as a possible product in the independent or non-scheduled market. Since military services have ruled that charters will be granted only to those carriers furnishing pressurized equipment, independent airlines are hoping to re-equip with more modern aircraft.

According to the Independent Airlines Assn., member carriers are not interested in the DC-7 because of its high operating and maintenance costs. Whether they will become potential customers for the DC-6B depends upon how much traffic they can expect to be diverted to them from the Military Air Transport Service schedules. This group's dilemma is that it cannot attract the traffic without aircraft and it cannot buy aircraft until it has the necessary traffic.

Global Market

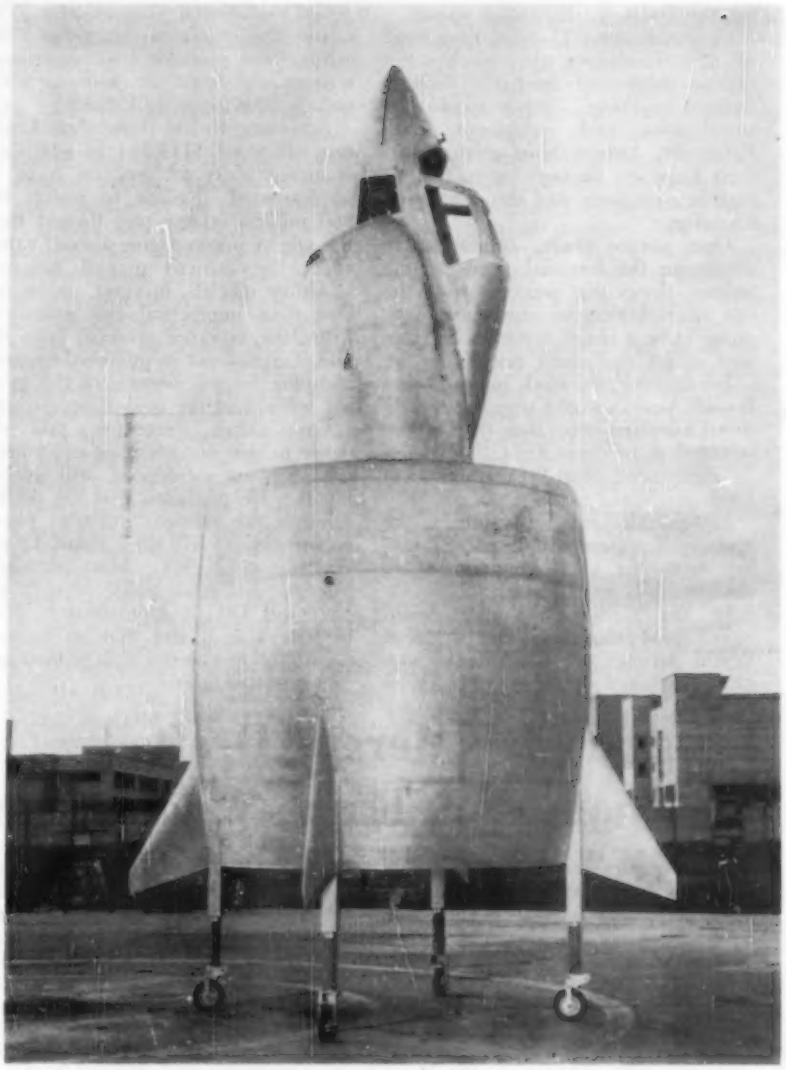
According to one private study of the used-plane market, the foreign market for long-range aircraft is also extremely limited. Again, foreign flag carriers with adequate cash and credit are making strong bids to enter jet transport competition and cannot be expected to buy piston-engine transport throwoffs from the very carriers with which they must compete.

Some experts in the used-plane field believe that during the next four years the market for medium-range aircraft in South America will continue strong. They warn, however, that price sacrifices must be expected and that requests for easy credit terms will accompany most bargaining.

Next largest potential market for medium-range equipment is in the Far East, although its demands for aircraft will be about one-fifth of that in the South American market during the next four years. Central America is considered to offer the third largest market. Western Europe indicates no potential. Africa a very limited market.

During the 1953-1956 period, 292 used-transports were exported from the U. S. Whether the rate can be increased as a means of disposing of surplus planes in the U. S. markets depends to no small degree upon a decision by the Export-Import Bank with respect to second-hand aircraft.

Although the bank has taken no official stand on the issue, one spokesman suggested privately that the bank might feasibly underwrite any borrowing on aircraft that have been taken in on trade-in by manufacturers if resold with a new plane warranty after reconditioning. Chances are strong that the aircraft manufacturing industry may bring the problem directly to the Export-Import Bank in hopes of gain-



French Build Flying Atar Coleopter

Latest configuration of the French Snecma Flying Atar VTOL (AW Nov. 11, p. 37) is based on von Zborowski Coleopter concepts. A Snecma Atar E turbojet is installed in a body built by Nord Aviation. The vehicle is scheduled to make its first flight in September. Only one prototype of the Coleopter exists.

Used-Plane Market Faces Critical Era

Low prices and poor business may be the hallmark of market as airlines dump piston planes for jets.

By L. L. Doty

Washington—Airline and aircraft industries are becoming alarmed over the prospects for the used-plane market, which is already glutted by an oversupply of aircraft. The market now appears headed for a prolonged period of slack business marked by slow turnovers and falling prices.

Both industries are convinced that the used-plane problem will reach an even more critical level during the next three years when the airlines dump their surplus aircraft into the market to make way for more than 400 turbine-powered planes. Here are the major problems facing both industries as a result of the soft second-hand aircraft market:

• **Used-plane market** for long-range, piston-engine aircraft such as the Douglas DC-7 series and the Lockheed 1049 series is virtually non-existent. Potential customers with sufficient cash or substantial credit are shopping in the turboprop or turbojet markets and are showing no interest in piston-engine planes.

• **Manufacturers are balking** at accepting trade-ins on the sale of new jet aircraft. They admit, however, that they may be forced to resort to a trade-in policy in some cases in order to sustain a profitable volume of sales. At least two manufacturers have launched used-plane sales campaigns—Boeing and Convair—in hopes of helping potential clients raise cash toward the purchase of jets.

• **Most airlines** say that projected financing of turbine aircraft was planned without heavy reliance upon proceeds from the sale of piston-engine planes and, therefore, the jet program will not be substantially affected by a collapse in the used-plane market. The fact remains, however, that the airline industry is still short of the capital it needs to support the jet program as it is now planned. Proceeds from the sale of aircraft obviously would help fill this financial gap.

Obsolescence Problem

For the first time in its history, the airline industry is faced with the problem of equipment obsolescence. Unless a market miraculously opens for larger piston engine aircraft, the factor of obsolescence could force airlines to store their surplus aircraft in mothballs in preference to flooding their routes with an excess of available seat miles.

Braniff already has grounded two Lockheed L-049s, Capital six of the same model, rather than attempt to keep planes in service at a loss. Some airlines feel that this is just the beginning of a retirement pattern many carriers will be forced to live with.

Ironically, the oldest transport plane in the market, the DC-3, is the one plane still attracting customers. According to one survey, the DC-3 in recent years sold for a typical price of $43,000 but climbed steadily to reach a typical price of $115,000 in 1956.

It is still a marketable airplane at a relatively high asking price because of a continuing demand for its use as an executive-type aircraft and as a reserve stand-by in charter service. An estimated average of 40 medium transports have been converted each year into executive planes since 1950.

Local service airlines will rely upon the DC-3 as a backbone of the industry for at least another three years. Nevertheless, and despite its extensive use, the DC-3 is expected to drop in price to $79,000 by 1959.

The DC-4 typical price hit a high of $590,000 in 1952, plummeted to $304,000 in 1954 and then climbed back to as high as $451,000 in 1956. The going price for the airplane, according to brokers, has gradually declined since then.

DC-7 Market

Resale price of the DC-7 has not yet been put to test to determine where the typical price will ultimately level off. However, American Airlines in a recent statement to the Civil Aeronautics Board predicted that the going price for the DC-7 may eventually dip as low as $200,000.

At present, a total of 215 DC-7s are in operation or on order by U.S. carriers with 69 of the same type in service by foreign flag carriers. The impact that the DC-7 will have upon the used-plane market is evidence by plans of United Air Lines to retire 36 of its fleet of DC-7s in 1961 and American's program of depreciating its entire fleet of 60 DC-7s by 1961.

American has admitted that, when the DC-7s were originally ordered, it was not expected that the turbojets would be available as early as 1958. The airline also said it has received no offers to buy the DC-7s it already has for sale.

Capital Airlines has had DC-7s offered it at prices "below $1 million" but the offers are made "as is" without any modifications or conversions to Capital's requirements. Convair is "assisting a client" in disposing of DC-7s on a sale, lease or lease-purchase

High-Altitude Sounding Rocket

Washington—Five-stage high-altitude sounding rocket is being pushed to operational readiness to monitor effects of out-of-atmosphere nuclear blasts in connection with Operation Hardtack, already begun at Eniwetok, in the Pacific.

Known as Project Jason, the rocket will carry an instrument payload to record radiation patterns and other effects, probably related to intercontinental ballistic missile interception techniques. Jason is under the cognizance of the Air Force Special Weapons Center, Kirkland AFB, N. M.

First of the monitor rockets (AW June 2, p. 15), having an altitude capability of 400 to 500 miles, is scheduled to be fired within a week from one of a group of three sites from which a total of at least 20 Jason rockets will be launched to sample Operation Hardtack blasts.

The Jason five-stage rocket consists of these solid-propellant, off-the-shelf, relatively inexpensive and proven elements:

- First stage—Honest John, obtained from Army Ordnance.
- Second and third stages—Nike boosters, obtained from Army Ordnance.
- Fourth stage—Thiokol Recruit.
- Fifth stage—Thiokol T55.

Aerolab Development Corp., of Pasadena, Calif., is the designer and assembler of the Jason rocket package. Aerolab was selected after a fast survey of the field, which included some of the major missile developers and builders. First Jason was specified for delivery within seven weeks after Aerolab received the go-ahead signal. Aerolab also is supplying the launcher—a simple, vertical "jack knife" type which suspends the rocket from top of a slant beam.

Assembly and launching crews for Jason are being supplied and trained by Aerolab. Lockheed Missile Systems Division, Sunnyvale, Calif., is designer of the instrument package, which weighs approximately 75 lb.

ing this badly needed credit source.

Generally, most U. S. carriers hope to raise funds for the purchase of turbine equipment internally through retained earnings, depreciation and amortization and equipment sales. Externally, carriers have programmed their financing through banks and insurance companies and through equity financing.

One private study, conducted to determine the financial needs of the airlines, shows that proceeds from the sale of piston-engine equipment may prove to be a major factor in the support of jet equipment purchases.

For example, the study indicates that Braniff Airways would require no additional financing other than that already arranged if proceeds from the sale of its equipment total $5.3 million in 1960.

Eastern Air Lines, according to the study, will require a total of $57 million from the sale of equipment to underwrite its jet program.

In the Civil Aeronautics Board capital gains proceedings, Pan American World Airways estimated that equipment purchased during the 1957-1960 period would total $266,641,000. The carrier also estimated in another CAB exhibit that proceeds from equipment retirements would amount to $60.5 million after applicable taxes.

According to the study, Pan American will need $115,284 in additional financing if its jet program is to be implemented. Failure to realize the $60 million or any part thereof from the sale of piston-engine aircraft would affect the carrier's over-all program.

Airline officials, however, are agreed that it is impractical and unrealistic to include expected proceeds from the sale of equipment in projected financial planning for jets because of the growing softness of the used-plane market.

One airline spokesman said the desire to own piston-engine equipment, once jets are introduced, will decline rapidly. He predicted that the market value of the average "modern" piston engine aircraft will drop about 12 per year through 1961. Most estimates indicate that resale value of such aircraft will fall to approximately 50% of today's level and that an increase in surplus inventories will prevent any resurgence in price.

Program for Merger Drafted By Thompson, Ramo-Wooldridge

Los Angeles—Thompson Products and its affiliate, The Ramo-Wooldridge Corp., will merge to become Thompson Ramo-Wooldridge Corp. if stockholders approve the plan. J. D. Wright, president of Thompson Products, will become chairman of the board and chief executive officer of the new corporation.

Dr. Dean Wooldridge and Dr. Simon Ramo, president and executive vice president respectively of Ramo-Wooldridge, will hold the same posts in the new firm. Present Thompson chairman, Fred C. Crawford, will head the executive committee.

The merger move follows on the heels of a recent announcement that Ramo-Wooldridge's Space Technology Laboratories had been established as a separatories had been established as a subsidiary corporation wholly owned by R-W, with Dr. Ramo as president. Space Technology Laboratories holds the technical management contract for Air Force's three existing ballistic missile programs and has accepted similar responsibility, at USAF's request, for the upcoming Minuteman intercontinental ballistic missile (see box). Laboratories hold similar responsibilities for USAF's lunar probe program.

Announced purpose of the merger is "to integrate capabilities of two organizations with the objective of expanding markets and better serving customers in the automotive, missile, aircraft, electronics, nuclear and general industrial fields." Combined company would have 1958 sales estimated at $300 million and would employ more than 20,000.

Original financial backing for Ramo-Wooldridge was provided by Thompson Products four years ago when the two scientists left top spots at Hughes Aircraft Co. after sharp disagreement with Howard Hughes.

In return, Thompson Products received 49% of the common stock in Ramo-Wooldridge, the balance went to the two founders, their top-level associates and to key employes as supplemental compensation.

When Ramo-Wooldridge received Air Force ballistic missile management contract, requiring a major expansion in facilities and personnel, it turned to Thompson Products for additional funds. These were loaned to Ramo-Wooldridge in return for an option which, if exercised, would enable Thompson Products to buy up to 84% interest in the 1962-64 period.

Within the past year, Thompson has increased its Ramo-Wooldridge holdings by another means—through purchase of stock from Ramo-Wooldridge employes who decided to sell off some or all of their holdings. At present, Thompson holds 57½% of the affiliate's stock, giving it controlling interest.

Pacific Semiconductors Inc., a wholly owned subsidiary of Ramo-Wooldridge, and the new Space Technology Laboratories, Inc., would become subsidiaries of new combined company. Astronautics Laboratory of Space Technology Laboratories Division also has been renamed Astrovehicles Laboratory.

Company official sees no immediate action to integrate Thompson Products' own electronics division, located in Cleveland, with Ramo-Wooldridge's West-Coast operation.

Consummation of the agreement is subject to certain conditions, including approval by stockholders.

Payment for the minority interest in Ramo-Wooldridge will be by 260,375 shares of common stock in the reorganized company, assets of which will be in the range of $200 million. Anticipated 1958 sales for combined company are estimated to exceed $300 million. For Ramo-Wooldridge, 1958 sales are projected at $55 million, of which about one half will be from the Space Technology Laboratories.

Of the 1958 Ramo-Wooldridge sales, approximately $10 million will come from production work, the remainder from research and development efforts. There are a number of military contracts which company holds outside Space Technology Laboratories.

Ramo-Wooldridge, which has just moved into a new research, development and manufacturing building complex near Los Angeles International Airport, a facility separate from the buildairport, a facility separate from the buildings of STL and the ballistic missile effort, also has a manufacturing plant near Denver. Firm also is seeking additional land in the airport area for future manufacturing facilities.

Minuteman Consultant

Los Angeles—Ramo-Wooldridge will serve as technical consultant to the Air Force on its upcoming Minuteman intercontinental ballistic missile program. The company's role will be similar to the one it played in USAF's three existing ballistic missile programs and lunar probe shots.

Advantages of the Minuteman system over the liquid fuel missiles now being developed were outlined last week in Detroit by Maj. Gen. John W. Sessums, Vice Commander of the Air Research and Development Command. Gen. Sessums said the best indication of the advantages is the over-all cost and that the Air Force anticipates that Minuteman will be cheaper than a liquid fuel ICBM by a factor of 10. This would indicate that the development part of the Minuteman program will cost less than $100 million.

More Fiscal 1959 Funds Asked For B-52, KC-135, Hound Dog

By Ford Eastman

Washington—Increased appropriations for Boeing B-52s, KC-135 jet tankers, North American Hound Dog air-to-ground missiles to be used on the B-52G and for research and development during Fiscal 1959 were urged last week by Sen. Henry Jackson (D.-Wash.), a member of the Senate Armed Services Committee.

Jackson, appearing before the Senate Subcommittee on Defense Department Appropriations, said he felt the 1959 defense program was deficient in those four categories in addition to the programs strengthened by House action earlier. He said the six programs that will be stronger because of House-increased appropriations are:

- **Cut in Army strength was rejected** to hold the service at 15 divisions.
- **Funds were added to maintain** a higher average strength in the Army National Guard and Army Reserve.
- **Provision was made to accelerate** the modernization of the armed forces.
- **Funds were provided to increase** the number of Polaris fleet ballistic missile submarines from two to six, for a total of nine, and to accelerate the Polaris missile-firing system.
- **Funds were added to accelerate** development of Air Force's Minuteman solid-propellant missile system.

Jackson recommended that the subcommittee add at least one wing of B-52Gs to the Air Force 1959 fiscal budget to give the U. S. 84 B-52Gs by 1961 instead of the 39 now programmed in the present budget. The senator said the Soviet Union is rapidly diminishing the U. S. lead in manned airpower and, at the current rate, will outdistance us in the near future.

Jackson said the Air Force originally requested $205.6 million in Fiscal 1959 for the Hound Dog to fully equip the B-52Gs with the new missile. This, he said, should be provided. House action was required, he pointed out, to provide even as much as $139 million. The House increased the Hound Dog fund request by $48 million.

The Senate committee also was urged by Jackson to provide funds for the addition of at least 60 KC-135 jet tankers in the budget. This, he said, would give the Air Force 86 additional KC-135s by November, 1960, rather than the 26 now programmed for the 1959 budget. By providing funds now instead of later, Jackson estimated that the total savings would amount to $7,224 million for the 86 KC-135s; for the 84 B-52Gs, he said, the savings would be about $13,776 million.

Jackson pointed out that the present program calls for a proportion of two tankers to every three B-52s, which will not be achieved until 1961. He added that the only operational jet tanker in prospect to refuel Convair's B-58 supersonic bomber is the KC-135 and that, since the new bomber requires tanker support on a one-to-one ratio, either more tankers will have to be built or a portion of tankers must be diverted from the B-52 force.

Jackson urged the committee to carefully consider increases both in the service research and development budgets and in the Defense Department emergency fund. He said not enough funds are being provided to assure the vigorous effort required for critical new weapons projects. He said:

"This country is engaged in a series of races of discovery with the Soviet Union. Some of these races involve highly critical projects—so that failure to be first in their completion causes a serious deterioration in our military and political position. We therefore must make sure that critical programs do not suffer from lack of funds.

"This means that adequate support must be given to important research and development projects now under way in the three services. This also means that the Defense Department needs substantial reserve funds to take advantage of sudden breakthroughs."

Jackson told the committee that in the next few months important breakthroughs may come in such fields as solid propellants, anti-submarine warfare, satellites, computer techniques, material and component developments, as well as in basic research.

He said the $2.7 billion provided by the House for research and development and the $150 million for the emergency fund, together with authority to transfer $100 million, was inadequate and that serious consideration should be given to providing more funds.

Germans Study Mirage III in Paris

Paris—Top level German delegation led by Defense Minister Franz Josef Strauss is in Paris this week for a last look at the Dassault Mirage III interceptor before making a final choice of a Luftwaffe fighter.

Despite persistent reports in European aviation circles that the Germans intend to select the Lockheed F-104 Starfighter, Dassault still hopes to get some German orders for its Mirage III. The Strauss mission, while intending to discuss Franco-German defense matters in general while in Paris, is nevertheless expected to devote a good portion of its time to studying the Mirage question.

The Germans are reportedly fairly enthusiastic about the French interceptor but feel its armament is not as sophisticated as the Starfighter's.

A Dassault spokesman, despite well-informed reports to the contrary, stoutly denied that a German test pilot recently seriously damaged a Mirage III during landing. What happened, according to Dassault, is that a tire on the Mirage III prototype blew when the German pilot made a hard landing and that some damage to the landing gear resulted. Noncompany sources in Paris and abroad said the fuselage was considerably damaged and that as a result, aircraft was a near washout.

In any case, in addition to the Mirage III prototype, Dassault is now flying a Mirage IIIA preproduction model and expects to fly a second pre-series model in September.

Northern Radar Cost Set at $800 Million

Buffalo—Building and installation of ballistic missile early warning system (BMEWS) radars at two sites in far north is expected to cost $800 million, a third more than the cost of constructing the DEW Line in the Arctic, with its 58 radar stations.

First figures on the total cost of BMEWS, and the exact number of radar stations in the DEW Line, were revealed by Deputy Secretary of Defense Donald A. Quarles, speaking here at the summer meeting of the American Institute of Electrical Engineers.

Quarles cited several examples of the growing cost and complexity of defense electronics:

- **Defense electronics** development and production is expected to total $4 billion in 1958, compared to around $750 million in 1951.
- **F-106 fire control navigation** system, being developed by Hughes Aircraft, has cost over $120 million. "Ten years ago a development cost of $10 million for an interceptor fire control system would have been considered excessive," Quarles said.
- **B-58 bombing-navigation system** development, and delivery of first test items, is costing over $110 million and requiring more than 1,000 man-years of engineering effort, Quarles said. System is being developed by Sperry Gyroscope.

Boeing B-52G Missile Bomber Nears Rollout

Workmen ready Boeing B-52G missile-platform bomber for rollout at Wichita, Kans., plant on July 23. Aircraft is structurally complete except for tail fin. Sophisticated version of B-52 Stratofortress will carry Hound Dog guided air-to-surface missiles which can be launched several hundred miles from targets. Wing has been redesigned for integral fuel tank use, reducing operating weight and increasing range. External changes include 8-ft. reduction in vertical tail height, elimination of aft gunner's compartment, larger nose radome and new nacelle contours on Pratt & Whitney J57-P-43W engines (AW May 19, p. 77).

Key ARPA Advisory Posts Filled

Washington—Eleven top posts in a 25-man scientific advisory group which will advise Advanced Research Projects Agency Director Roy W. Johnson by conducting studies, reviews and evaluations, were disclosed last week.

The 25 scientists, whose function is limited to an advisory capacity, are members of newly formed Advanced Research Projects Division of the Institute of Defense Analysis (IDA). New division is headed by Dr. Herbert York who also is personal scientific adviser to Johnson as ARPA's chief scientist.

(Institute is a non-profit organization jointly operated by five universities which was originally set up to serve as scientific consultant to Joint Chiefs of Staff and Defense Department in evaluation of new weapons and techniques. Institute's Weapon System Evaluation Group consists of 85 civilian scientists and military officers.)

New Advanced Research Projects Division consists of three groups:

- **Space Science and Technology,** David Young, Coordinator.
- **Ballistic Missile Defense,** William Hutchins, Coordinator.
- **Advanced Solid Propellant Chemistry,** Dr. John F. Kincaid, Coordinator.

The Space Science and Technology group consists of eight panels, with chairmen as shown below:

- **Man-in-Space:** Dr. S. B. Batdorf.
- **Military Satellites:** Charles R. Irvine.
- **Large Engines:** Dr. Arthur J. Stosick.
- **Communications Relay:** George Brady.
- **Meteorology Investigation:** Roger S. Warner.
- **Scientific Satellites:** R. B. Canright.
- **Exploratory Research:** R. Youngquist.
- **Satellite Tracking:** Richard S. Cesaro.

Scientists for new ARPA advisory group have been hired by Institute and are on its payroll. Approximately half of the scientists came from government laboratories, the remainder from industry. Scientists who came from industry will not participate in evaluation of any proposals submitted by their former employers, Institute spokesman says.

Results of Institute scientists' evaluations will be forwarded to Johnson who can accept or reject them, based on considerations other than technical ones. ARPA can either assign responsibility for new programs to one or more military departments or contract directly with industry or universities, depending upon the situation involved.

Other recent staff appointments announced by Johnson include:

- **Office of Program Control** & Administration, headed by Lawrence P. Gise, will handle planning, financial, contractual matters.
- **Office of Foreign Developments,** under William H. Godel, will explore foreign research efforts which can assist on ARPA programs.
- **Special Assistant** to ARPA Director: Lambert L. Lind.
- **Special Assistant** to ARPA Chief Scientist: James O. Spriggs.

Deputy director Rear Adm. John E. Clark, USN, is assisted by a military advisory group consisting of Col. R. G. Thomas, USA; Capt. R. C. Truax, USN; Cdr. L. A. Kurtz, USN; and Col. D. L. Lay, USAF.

Johnson says ARPA's presently planned staff is "essentially complete."

ARPA Sponsors Nuclear Study

Advanced Research Projects Agency is sponsoring feasibility study on possibility of using controlled nuclear explosions for rocket propulsion and will launch number of important new programs as soon as Fiscal 1959 funds become available. ARPA expects to receive $520 million, more than 10 times the amount contracted since agency was formed in February. Summary of contracts released by ARPA includes:

- **Air Research & Development Command is administering number of study contracts, including bomb-propelled rocket and another on extremely high-thrust engines.**
- **Army Ballistic Missile Agency has been authorized to launch two lunar probes, a cosmic ray experiment, and inflatable satellite and two corpuscular radiation experiments.**
- **Air Force Ballistic Missile Division has been requested to launch three lunar probes.**
- **Naval Ordnance Test Station is developing a mechanical ground scanning device for use in lunar probes.**
- **Office of Naval Research has awarded number of small study contracts of undisclosed nature.**
- **Naval Research Laboratory and Army Ballistic Research Laboratories have been asked to develop and install combination Doppler radar, Minitrack radio network to detect and track non-radiation satellites.**

Number of classified projects utilizing talents of all three military services also have been authorized, ARPA says.

U. S. Airpower Stars at Liege Jet Show

By Robert E. Farrell

Liege, Belgium—Three day international jet air show here was dominated by the largest public display of U.S. airpower ever seen in western Europe.

Liege show, sponsored by the Belgian government, began on a modest scale and gradually mushroomed into what many observers ranked as the most impressive military airpower display yet held in western Europe. Show was attended by top NATO and U.S. military officials including Gen. Curtis E. LeMay, USAF vice chief of staff.

Only NATO country conspicuously absent was the Netherlands. Dutch were involved with preparations for an international air show to be held this week at Soesterberg, near Amsterdam.

Despite 12-nation participation at Liege, interest centered on U.S. aircraft, several of which were on public display for the first time in Europe. These included Navy equipment flown to Liege from Sixth Fleet carriers Essex and Saratoga, marking the first time the Navy has participated in any European air show. U.S. aircraft making their public European debut at Liege were: KC-135; fitted out as a SAC command ship, the aircraft flew Gen. LeMay's party from Andrews AFB to Liege in 6 hr. 44 min. KC-135 was part of a static display. Lockheed F-104B; two of these aircraft were airlifted from the U.S. in a C-124 directly to Liege. Starfighter participated both in static and flying display.

McDonnell F-101; highlight of the Liege show was an Atlantic crossing made by four Voodoos directly to Bierset Air Station from Andrews AFB. Aircraft covered 3,455 naut. mi. in 6 hr. 11 min. Not pushing for a record flight, the Voodoos made the crossing flying a loose formation between 31,000-35,000 ft. In the middle third of the trip, the Voodoos flew along with four KC-135s and took on fuel three times. Only mishap was loss of a boom by one tanker which cut out of operation and landed in England. Led by Maj. John R. Burns, the Voodoos were from the 522nd Fighter Bomber Squadron, unit of the 27th Fighter Bomber Wing, Bergstrom AFB, Austin, Tex.

Navy aircraft making their European debut were: Chance Vought F8U-1 Crusader; McDonnell F3H Demon; Douglas A4D-2 Skyhawk; Douglas A3D Skywarrior; and North American FJ-3 Fury. All these aircraft were on static display and were presented during the flying portion of show.

Indicative of the way the Liege show came about, Navy officials say they weren't invited at the outset but made inquiries after hearing reports that a Belgian show was in the works. Navy aircraft, unlike USAF equipment on display at Liege, probably won't show up at the Dutch air show.

Flying portion of the Liege show was held down by bad weather. Acrobatic teams from Italy, Portugal, Great Britain, Belgium, Turkey, Greece and the United States took to the air but much of their crowd-pleasing maneuvers had to be abandoned because of low ceiling and bad visibility.

Italian 6th Air Brigade "Red Devils" team, which is earning a European reputation as "crazy daredevils," managed to maintain its standing by demonstrating new finale low pass maneuver. Using six aircraft, the Italians executed a low crisscross over center field with one pair coming north and a second pair coming south, one boring in from the west and number six from the east. Italian team is now flying F-84Fs in place of the former Canadair Sabres flown last year by the 4th Air Brigade.

Main point of the flying display was a combined takeoff of Voodoo and Starfighter followed by a high speed pass made by the two aircraft over the crowd. Attempt at a joint landing was botched when F-104 brake chute failed to open and the Starfighter had to climb out.

Navy flying display was confined to a single formation flyby of Skywarrior, Demon, Skyhawk and Fury followed on by single high speed pass of Crusader.

Industrial exhibits at the Liege show were few and fairly makeshift arrangements. No American exhibits were scheduled though General Electric Co. gas turbine representatives managed late on the last day to get permission to display their J79 which was one of two reserve engines carried along by the Starfighters. Lockheed Aircraft officials helped USAF arrange F-104B demonstration rides for Belgium and NATO officials.

Missile layout at show was meager. Nord company from France dropped one of its 5103 air-to-air missiles at the entrance to the French Snecma tent, but no Nord company official seemed to be present to discuss the missile. De Havilland showed a mockup of its Firestreak air unit and Bristol, with the best layout at the show, showed for the first time in Europe, its Bloodhound ramjet anti-aircraft missile.

Single U.S. missile was a Douglas Nike Ajax placed on demonstration by a unit of the U.S. Seventh Army from Germany.

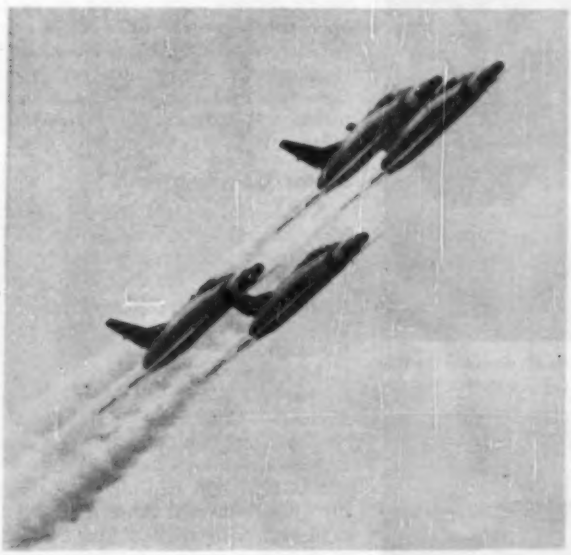
Sign in front of the missile informed Belgians that their government was taking delivery of Ajax and Nike Hercules next September.

FRENCH Dassault Super Mystere takes off at Liege air show. French also flew Breguet Alize, Breguet Taon, Nord Noratlas, Air-Fouga Magister and Sud Alouette and Djinn.

ITALIAN "Red Devils" acrobatic team crisscrosses airport as finale to team bomb-burst maneuver. Three of six aircraft are shown here.

AFTERBURNERS on, McDonnell F-101 and Lockheed F-104B make combined takeoff as part of Liege air show (above and below).

FLANKED by 12 North American F-100 jet fighters, four Douglas B-66 twin-turbine bombers form center of this Liege flyby.



SKYBLAZER acrobatic team, flying F-100s, makes a pass during a show demonstration which was hampered by low ceiling.

U. S. NAVY pilots make low pass in trail formation. Shown, from top, are Douglas A3D, McDonnell F3H, North American FJ-4 and Douglas A4D.

First SAGE Direction Center Operating

By James A. Fusca

McGuire AFB—Air Force has accepted and placed in operation the first Direction Center of its Semi-Automatic Ground Environment (SAGE) system at McGuire Air Force Base, Trenton, N. J., to direct the operations of the New York Air Defense Sector.

SAGE system is designed to improve the capacity and effectiveness of the U.S. air defense system by substituting highly automatic data processing equipment for the manual plotting and interception methods presently in use.

Three principal functions of the SAGE system are:

- **Acceptance and correlation** of target information from many types of detection and tracking radars.
- **Identification of aircraft** entering the system either by flight plan correlation or visual identification.
- **Direction of employment** of defense weapons to prevent penetration of the system by hostile aircraft, manned or unmanned.

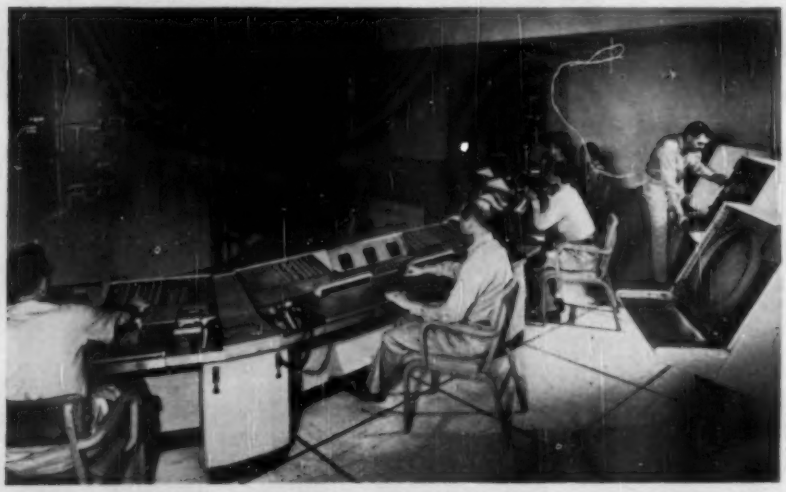
System's Effectiveness

Present capability of the SAGE system is for defense against piloted aircraft and cruise missiles, does not extend to hypersonic ballistic missiles. The system's proponents, however, point out that the main Soviet threat, at least for the next two years, will be from manned bombers.

Additionally, SAGE installations are said to be capable of modification and improvement as new types of equipment are developed. For example, defense against intercontinental ballistic missiles would require additional radars with much greater range, resolution and tracking speeds to supply input data to the system, an expanded and refined SAGE computer, or a separate anti-missile computer and new anti-missile weapons to carry out the interception orders generated by the computer.

By the end of 1961, the Air Force plans to have 29 SAGE sectors in operation covering the entire U.S. Additionally, Canada may install two similar sectors as part of the joint U.S.-Canadian air defense effort.

In the event of an air attack, defense components of all three services within an air defense sector come under the operational control of a Continental Air Defense (CONAD) commander, including Air Force interceptor and Bomarc squadrons, Army missile batteries, and assigned Navy and reserve units.



VISUAL display of air situation is presented for staff analysis and command decisions in this SAGE control center room. Display is generated by AN/FSQ-7 SAGE computer system.

FIELD engineers man AN/FSQ-7 SAGE computer maintenance console. Console shows the operating status of system's electronic equipment to assure instant maintenance in event of failure. Digital computer also is duplexed as another safeguard.

Sector Coordination

SAGE system will include facilities for cross-telling information about the air battle to adjoining sectors and to a Combat Center, which coordinates actions within a group of air defense sectors. New York Air Defense Sector, for example, will be tied into a Combat Center located in Syracuse, N. Y., due to become operational in September. From this Combat Center, the defense of the northeastern U.S. will be coordinated.

SAGE system basically is a network of interconnected direction centers equipped with large digital computers that receive input information relating to the detection and identification of enemy aircraft and provides output information in the form of battle orders to defense weapons.

The duplexed AN/FSQ-7 digital computer installed in each direction center is said by International Business Machines Corp., the manufacturer, to be the largest and fastest computer in the world, capable of performing 65,000 computations per second. It is duplexed so that one unit can be out of service for maintenance or repair while the other unit is in operation.

Target data inputs to the computer originate at radar sites within the sector or are cross-told from adjoining sectors. Within the sector, the final SAGE system will use such radars as Bendix Avia-

tion Corp.'s AN/FPS-20 long range surveillance radar and AN/FPS-14 gap filler radar.

At the radar site, the raw radar data is converted by Burroughs Corp. AN/FST-1 or 2 data processing equipment to filtered binary data which is transmitted over standard telephone lines to the direction center where target coordinates are inserted into the computer and displayed.

Four Types of Data

In general, the data fed into the computer is of four types:

• **Long range radar.** Range, bearing and altitude information on detected aircraft is received from heavy ground radars and height finders, Texas towers, radar picket ships, and airborne early warning aircraft.

• **Gap filler radars.** Position data on aircraft screened from the long range radars by terrain features or earth's curvature is transmitted to the computer from medium range gap filler radars.

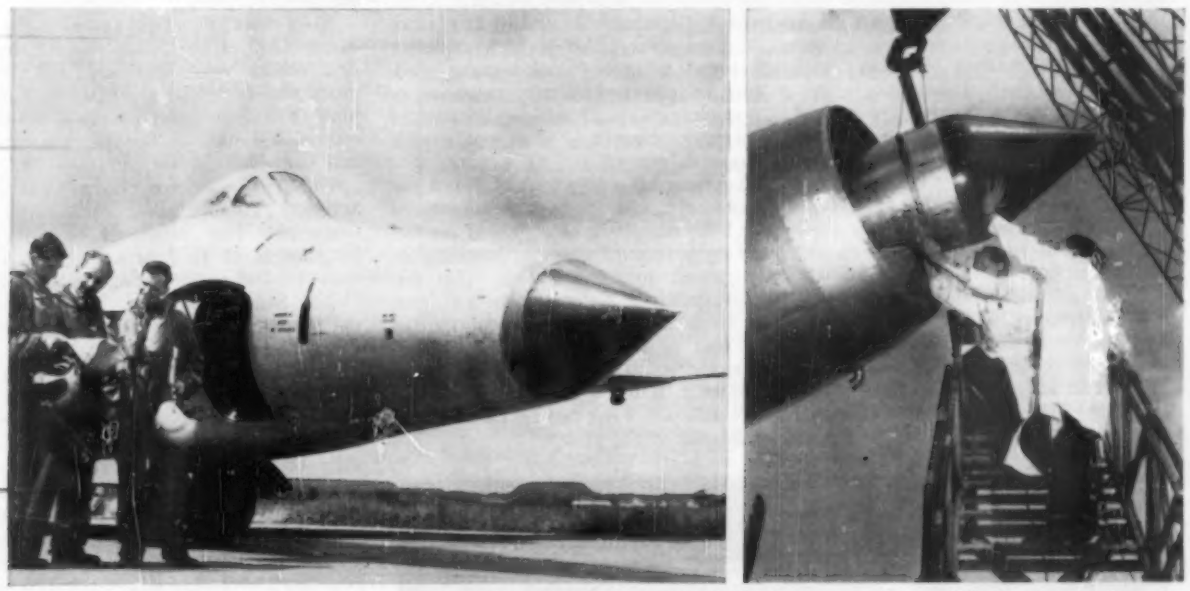
• **Cross-tell equipment.** Air threat situation in one sector can be transmitted to or requested from an adjoining sector's computer to provide a composite picture. Identification of friendly aircraft entering a sector would be cross-told from the adjacent sectors.

• **Manual input equipment.** Data can be inserted into the computer or obtained from it by means of such equipment as punched cards, manual keyboards, printers and oscilloscopes.

Computer stores previously received information in its memory banks. As new data is inserted, the computer compares it with stored data and—as directed by an extremely complex computer program—performs the navigational computations to project target track data, assesses and evaluates the attack threat in terms of the deployment and speed of available defense weapons, and displays this data so that operators can assign and direct weapons on the basis of continuously current air battle information.

Data Links System

At a future date, plans call for a further step in automatic data handling with the installation of General Electric's AN/GKA-4 Flight Control Group, more familiarly known as a data link system. In use, vectoring information generated by the SAGE computer will be converted for transmission by UHF radio directly to manned interceptors or ground-to-air missiles where receiving equipment will reconvert the data into instructions sent to the interceptor's autopilot or missile guidance system.



AIRPASS radar and fire control system is tested on English Electric Canberra at left, after nose section modification to contain center body of P.1B. At right, technicians install the center body in drastically-rebuilt nose section of Douglas Dakota transport.

P.1B Shock Inlet Houses Radar, Airborne Fire Control System

Bonn—Center body of English Electric P.1B engine intake contains new airborne radar and fire control system designated Airpass and demonstrated here to West German Air Force.

Need for more radar in nose position led to design of circular single shock inlet with center body (AW Sept. 30, 1957), following extensive testing of P.1A prototype. Radar details were not previously revealed.

Airpass, designation for airborne interception radar and pilots attack sight system, was demonstrated by Ferranti Ltd., of Edinburgh, as climax to five year development program. Company claims system is one of the most advanced now used. Made of two basic units, radar and sighting, Airpass locks onto target through a wide angle scanning system.

Airpass housing in P.1B center body does not increase frontal area and at same time provides a good aerodynamic shape, officials said. Primarily designed for interception attacks without visual contact, system also incorporates visual sighting methods.

Range and speed information are fed to the sighting unit. A computer then calculates best interception approach course and displays this to the pilot.

Automatic warning systems inform the pilot to break off attack if he is tending to overshoot the target.

Airpass flight trials were first made in Douglas Dakota and then later in a Canberra modified to produce conditions as near as possible to those in the P.1B.

Ferranti spokesman said Airpass is "small enough and light enough to be installed even in a lightweight fighter," such as the Folland Gnat.

Army Shows Rocket, Missile Capabilities

By Craig Lewis

White Sands, N. M.—Army showed off its family of rockets and guided missiles here last week in a demonstration of its air defense and brush war firepower capabilities.

Group of high-ranking government, NATO and industry representatives witnessed firings of nine rockets and missiles ranging from the long-proven Honest John to the new Hawk low-level air defense missile. They also saw a demonstration of helicopter firepower the Army is developing for battlefield use.

The show was a clear demonstration of the Army's preparations for the limited, brush fire type of warfare it must be prepared to fight. The performances of the weapons shown was used to back the Army's arguments that the U.S. must and can be prepared to meet these small, limited warfare challenges with an arsenal of modern weapons.

In two days of firings here and at nearby Ft. Bliss ranges, nine weapons were launched on a precise schedule and visitors, used to the problems of large liquid-fueled missiles fired at Cape Canaveral, were impressed with the manner in which the new missiles in the group met their firing schedules.

These missiles were demonstrated:

• **Nike Hercules**, which is now on site in New York, Chicago and Washington, was fired at a simulated target flying at 650 kt. and at 100,000 ft. at a range of 50 mi. Intercept was called successful because the 5,000 lb. missile hit 25-50 ft. from the center of the simulated target. This was the first public showing of a Nike Hercules launching.

• **Hawk hit a low-flying** QF-80 drone in its first public firing. The Hawk, which is 16 ft. long and weighs 1,285 lb., intercepted the drone at a five mile range and an altitude of 500 ft. The drone exploded and dropped to the desert floor in flames.

• **Talos was fired** at a B-17 drone. Launching was successful, but a new type of warhead being fired for the first time failed to detonate, and the intercept failed. Navy-developed ramjet missile was launched from the Talos land-based system delivered by RCA last October to the Army for evaluation. Newer version of Talos, with expanded fuel capacity, will probably stretch the missile's range to about 100 mi. It can be fired with either a high explosive warhead using terminal homing guidance with four small nose antennas, or a nuclear warhead which, because of its greater blast area, does not require terminal homing.

• **Lacrosse hit a target** which was a six-foot-long 2 x 4 in. post at a range of 16,500 yd. Missile was guided on target by a forward observer handling its command guidance system. This forward guidance system is broken down in 50 lb. units so it can be transported by foot in areas a jeep cannot enter. Lacrosse is 20 ft. long and 20 in. in diameter. It has a 9 ft. wingspan and 4 ft. tailspin. First tactical Lacrosse was displayed to the group.

• **Little John**, a smaller version of Honest John, is a free rocket which is designed to be carried by helicopter. It was fired over a range of 10,000 yd. for an air burst demonstration. Under good flight conditions, the 12 ft. Little John and its 1,800 lb. launcher can be carried in an H-34 helicopter. Larger H-37 can carry the system and its crew.

• **Dart wire-controlled** anti-tank missile hit an M4-A3 tank at a range of 7,000 ft. Dart, which weighs less than 100 lb., is propelled by a dual thrust solid rocket motor.

Group also saw a demonstration of some older weapons. Honest John was fired in a demonstration of the Chopper John concept in which the rocket and its launching system are transported in three H-37 helicopters for field launching.

Nike Ajax knocked down a B-17 drone. One of the Nikes aborted, but two others were launched and the drone was destroyed at 17,000 ft. Corporal surface-to-surface missile, which is now stationed in Europe, was fired and impacted 31 mi. away.

Group was briefed in the smaller Sergeant missile which will replace Corporal. The solid-rocket-propelled Sergeant is 32 ft. long and 31 in. in diameter and is now being test fired at White Sands. Group was also briefed on Redstone, which was released recently to tactical units.

Performance of the new missiles which were demonstrated showed the advantages of solid propellant rockets for field use, since all but Talos were solid powered. They also showed how the Army is moving into the area of close tactical support with its missiles to replace the close support function of fighter-bomber aircraft, which are becoming too fast to do the job.

Another possibility for close support work was demonstrated in a show of helicopter firepower. H-13, H-19, H-34 and H-21 helicopters fired various combinations of machine guns and rockets, including a new 1.5 in. rocket developed for the helicopter program by Rocketdyne Division of North American Aviation.

Although the helicopter program is still an experimental project at the Army Aviation School, Ft. Rucker, it is being developed under an aerial cavalry concept which could perform the reconnaissance, intercept, fire support and rapid troop movement functions once handled by horse cavalry. And it could develop weapon systems which could take over some of the close troop support mission which the faster jet aircraft cannot handle.

A new unit, the 7292nd aerial com-

USAF Honors Gen. Putt

Lt. Gen. Donald L. Putt, retiring deputy USAF chief of staff for development, receives the Distinguished Service Medal from Gen. Thomas White, USAF chief of staff, at a Pentagon ceremony. Gen. Putt, who retired June 30 after 30 years of military service, was one of the pioneers in aeronautical research and development and is a former commander of the Air Research and Development Command.

bat reconnaissance company (experimental), was formed in March to develop and demonstrate this new concept. It consists of two H-13 machines for command and 13 of them for the reconnaissance function. Troops are carried in four H-21 helicopters, and four H-19s are the weapon section. Supply section consists of two H-34s, and the medics fly in an H-13.

Army has had help from industry in this program. Such companies as General Electric, Rocketdyne and Sikorsky Division of United Aircraft have spent their own money on various devices and projects, and it appears that the Army may now be getting ready to spend some money with industry.

Commenting on the various means the Army uses to develop its missiles, Maj. Gen. J. B. Medaris, commander of the Army Ordnance Missile Command, pointed out that while the Army rocket and guided missile agency gives contracts to industrial prime contractors, Army Ballistic Missile Agency acts as its own system manager. He said that "maybe the ideal method lies somewhere between" these two systems. As an example, Medaris mentioned the award to the Martin Co. of the Pershing contract, but at the same time, he emphasized the need to do a part of the work at Army facilities.

Dh. W. H. Pickering, director of the Jet Propulsion Laboratory, discussed the Explorer program. He said that both high and low power transmitters in Explorer III began to fail on May 8, six weeks after launch. Since the transmitters were independent, this would seem to indicate that both were damaged by meteoritic particles.

U. S.-U.S.S.R. Race

Discussing the broader aspect of the missile race between the U.S. and Russia, Dr. Pickering said that the USSR satellites "are direct and incontrovertible evidence of a technology capable of successfully building guided missiles or any range up to the ICBM."

Referring to the weapons shown at White Sands last week, Dr. Pickering said, "We must not forget that Russia can probably match them, weapon for weapon, and that our missile technology is not leading the rest of the world." He said the problem is not one of scientific breakthroughs, but one of sound planning, sound engineering and good management.

Army was authorized last week by Advanced Research Projects Agency to build a radio antenna at Camp Irwin, Calif., capable of maintaining communications with space vehicles. The 85 ft. antenna will be built by Jet Propulsion Laboratory and will be the first step in the development of a system for communicating with lunar vehicles.

KC-135 Sets New Record

Westover AFB, Mass.—Two Air Force KC-135 jet tankers broke transatlantic speed records in both directions last week. The third aircraft in the group crashed on takeoff from here with the loss of 15 lives; the fourth's flight was cancelled.

Seven crew members, two National Aeronautics Assn. observers and six newsmen were aboard for the fatal takeoff.

Those killed included Brig. Gen. Robert W. Saunders, operation commander of the exercise; Robert Ginsberg and Glenn Williams, U. S. News and World Report; James L. McConaughy, Jr., Washington bureau chief of Time and Life magazines; Norman Montellier, United Press International; Daniel J. Coughlin, Associated Press, and Robert Sibley, aviation editor of the Boston Traveler.

Maj. Gen. Joseph D. Caldera, Air Force flight safety director, speaking for a 46 man investigation team, reported that it has definitely been established that the aircraft did not explode or catch fire in the air. The wreckage, he said, was scattered over a three-acre area by the force of impact rather than from an explosion.

The tanker struck a 26-ft.-high tree with its left wing and fuselage about one mile from the end of the runway. The KC-135 which crashed and the one which was kept on the ground were loaded to almost maximum gross weight because they planned to fly to London and return nonstop. The first two aircraft which completed the operation landed in London on schedule and took off from Westover with a much lighter fuel load for the one-way crossing.

West-to-east record, set by the first tanker, designated Alpha, was five hr. 27 min. 42.8 sec. for an average speed of 630.2 mph. Return trip was made on June 29th. Alpha had the best time and set the new record east-to-west of 5 hr. 51 min. 24.8 sec.

These times bettered the old marks set in 1955 by an RAF Canberra bomber—seven hr. 29 min. east-to-west and six hr. 16 min. west-to-east.

In direct conjunction with the Liege air show, Gen. Curtiss E. LeMay, Air Force vice chief of staff, flew from Andrews AFB, Md., to Liege nonstop in his KC-135 on June 27. On the following day, four F-101 fighters flew the same route at an average speed of 640 mph. The aircraft were refueled en route and the flight was completed without landing.

Army Secretary Wilber Brucker said that the same team that produces the Explorer satellites is working on the Jupiter-powered lunar probes the Army has been authorized to develop. Brucker said ARPA will decide whether the Air Force or Army makes the first shot.

Brucker also said that the U. S. work on the re-entry nose cone problem is far ahead of anything Russia has done. He said he has "seen nothing from the other side that leads me to believe that they have it."

He said the Russian tendency to brag would probably have revealed any breakthrough in the Russian state of the art.

News Digest

Lockheed Aircraft engineering test pilot James F. Holliman, Jr., was killed last week when his F-104B Starfighter crashed on final approach to runway 22 at USAF Plant 42, Palmdale, Calif. Crash occurred approximately 2,000 ft. from end of the runway on what appeared to be a completely normal approach. There were no radio calls from the pilot indicating trouble. Holliman was the Lockheed pilot who conducted spin tests during F-104 engineering flight test program earlier. No details were given of possible causes of the crash.

James R. Dempsey, 36, manager of Convair-Astronautics, has been appointed a vice president of the Convair Division of General Dynamics Corp. Dempsey, who joined Convair in 1953 as staff assistant to the vice president for long-range planning, will continue as manager of the Atsronautics Division and as program director for the Atlas Intercontinental Ballistic Missile, a post he has held since 1954.

Pan American pilots would earn as much as $45,000 a year if Air Line Pilots Association demands were met, the airline says. ALPA and Pan American are negotiating jet pay terms. Carrier has offered up to $28,589, it reports, for a jet captain flying 85 hr. per month.

North American B-70 Mach 3 bomber has been officially named the "Valkyrie" by the Strategic Air Command. Name was selected from entries submitted by SAC officers and men.

Experimental reactor for use in Project Rover nuclear rocket program has been completed by the Atomic Energy Commission. The reactor known as KIWI-A will be used in initial static ground tests later this year at the experimental facilities at Jackass Flats, Nev.

at 85%. He said his only recollection of trouble was "an explosion" and the aircraft "tumbling around." The pilot added his first news of the collision was told him in the hospital.

Pilot's Record

In answer to panel members' questions McCoy testified he has 1,900 flying hours accumulated since 1944. Of this total, 600 are in jets, including 250 hours in the T-33 in which he has served as instructor for the 104th Fighter Interceptor Squadron of the Maryland Air National Guard.

Although he flew the jet a few days before the accident, Guard records show that prior to that it had been 84 days since his last flight. Minimum periods between flights adopted by the 104th is 60 days.

McCoy explained that, since his unit's standards were more strict than those of the Air Force, "we have a certain amount of latitude."

Capital Airlines attorneys called for Air Force records which they said show that McCoy had two previous flight accidents. While the National Guard pilot at first declined to testify on this matter on the grounds that prior accidents had no bearing on the Brunswick crash and were also classified documents held by the Air Force, he gave a full account on the last day of the hearing.

In the fall of 1945 he said that, while observing a gunnery range practice, he was flying behind a tow plane in a nonfiring area when a fellow pilot "made a pass" and the two P-63s collided.

The other pilot bailed out, McCoy successfully landed his aircraft.

Four years ago, the right wing of his F-51 hit the tail assembly of another aircraft during maneuvers of a three-plane formation. Again, he said, the pilot of the other plane parachuted to safety while McCoy landed.

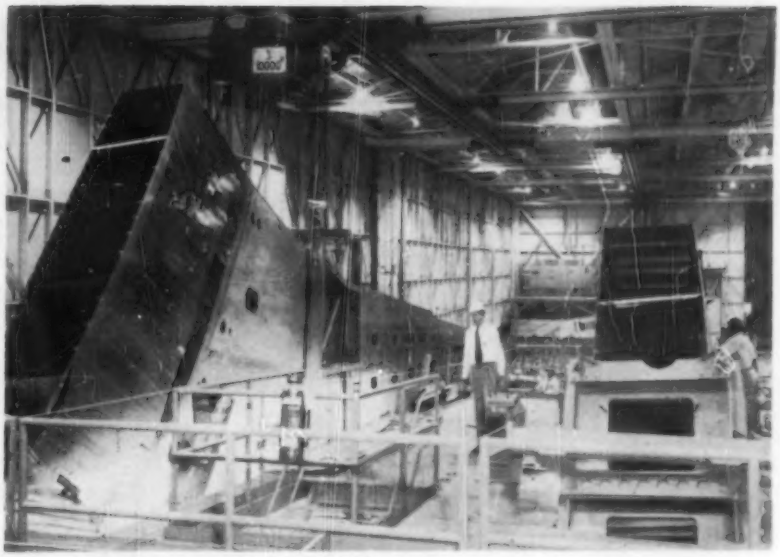
CAB Vice Chairman Chan Gurney, who headed the panel, closed the hearing with a reminder that any new evidence would be grounds for a reopening of the investigation.

Competing Airlines Distribute Services

New York—Three European airlines have entered into a cooperative scheduling arrangement on the South Atlantic route to provide an even distribution of service throughout the week. Air France, Alitalia and Lufthansa have staggered their summer South Atlantic frequencies to avoid duplication of most schedules.

Under the arrangement, Air France's Super G Constellations leave Paris on Tuesday, Thursday and Sunday for South American destinations; Lufthansa's Super Gs leave Hamburg on Monday, Wednesday and Saturday, and Alitalia's DC-6Bs leave Rome on Thursday and Sunday. All services are in mixed configuration.

The South Atlantic flights are multi-stop schedules. For example, Air Frances's Thursday departure from Paris stops at Madrid, Dakar, Rio de Janeiro, Sao Paulo, Montevideo, and Buenos Aires.



Convair 880 Wing Is Completed

First wing for Convair 880 jet transport is hoisted from one of six major wing assembly fixtures at company's San Diego, Calif., plant. Second wing is in right foreground. Next step is baking in electric oven to create integral fuel tanks by Scotchweld method. Transport's swept-back wings have 120 ft. span and area of 2,000 sq. ft. Both halves will be mated into single wing next month. Assembly is under way on Convair's first four jet transports.

Air France, Aeroflot To Fly Moscow-Paris

Paris—Air France this month will begin serving Moscow from Paris on a bi-weekly basis using super G Constellations. Under a bilateral agreement between France and the Soviet Union, the Russian carrier Aeroflot will start its bi-weekly service at the same time as Air France using Tu-104A jetliners. Both carriers agreed to offer flights on a mixed basis with first and tourist class seat configuration. Air France-Aeroflot pact follows recent agreements between the Russian carrier and British European Airways, KLM Royal Dutch Airlines and Sabena.

Prior to these agreements, the only western carriers permitted into Moscow were Finnair and SAS.

Paris aviation circles also report that Aeroflot officials indicated, while here, that the Russian carrier may soon apply for IATA membership.

Senate Unit Urges Transport Survey

Washington—Senate Commerce Committee is asking for $100,000 to begin an extensive study of transportation systems within the U. S.

Sen. Warren Magnuson (D.-Wash.), the committee chairman, said these points will be covered in the study:

- **"The need for regulation of** transportation under present-day conditions and, if there is need for regulation, the type and character of that regulation. . . .
- **"The area of federal policy dealing** with government assistance provided the various forms of transportation and the desirability of a system of users' charges to be assessed against those using such facilities.
- **"The subject of the ownership** of one form of transportation by another. Such ownership, except in unusual cases, is generally either forbidden or made extremely difficult under existing statutes.
- **"Federal promotional policy** in regard to various forms of transportation."

The Senate Rules Committee has approved the initial $100,000 request. Magnuson said that "it will no doubt be necessary, at a later date, to request a substantial additional amount of money to continue and complete this vital project." He said that a staff of experts would make reports to the committee on key aspects of the transportation picture within 18 months.

CAB Probes Viscount, T-33 Collision

Obsolescence of air traffic control radar system emphasized as Board begins hearings on accident.

By Robert H. Cook

Washington—Obsolescence of existing air traffic control radar highlighted testimony last week at a fact finding panel of the Civil Aeronautics Board investigating the May 20 collision of a Capital Airlines Viscount and a Maryland National Guard T-33 jet trainer (AW May 26, p. 25).

The accident, near Brunswick, Md., claimed the lives of 11 persons aboard the airliner and a passenger in the T-33 trainer which was piloted by Air National Guard Capt. Julius McCoy who parachuted to safety.

Eyewitness accounts from residents of the area, were in general agreement that the two aircraft were headed east when the T-33 overtook the Viscount and made a sharp right bank into the nose section of the airliner. McCoy, however, said that neither he nor his passenger, National Guard Pvt. Donald A. Chalmers, saw any aircraft in the vicinity. He said he was only aware that he had been "blown from the plane" by an explosion.

Radar controllers at Washington National Airport spotted the two planes seconds before the accident but the range and reception of their surplus Air Force radar equipment failed to present the picture clearly enough to pinpoint the possible collision.

Controllers Testify

Controller Charles A. Layman, who was watching an area between Martinsburg, W. Va., and Baltimore, testified that he had sighted Capital's flight 300 and granted the pilot permission to descend to and maintain 7,000 ft. over Martinsburg. He then asked Baltimore area controller Charles A. Floyd to relieve him for a few minutes. Upon his return, Floyd pointed out the Capital flight and said he had given a clearance for the Viscount to descend to 5,000 ft. over Sugar Loaf Mountain on an approach to Baltimore's Friendship International Airport.

Both controllers observed the flight for a full minute during which time neither saw any other traffic in the area. Seconds after Floyd returned to his position, Layman spotted a faint return of another target and, on the second cycle of the radar sweep, the target seemed to disappear while the Viscount blip was greatly enlarged, Layman said.

As he attempted to contact the flight to determine its altitude in order to advise of possible VFR traffic, the radar blip expanded to cover an area of nearly three miles, he said. This picture remained almost stationary on the radar screen for one and a half minutes before fading.

The controller said a quick check of radar and other navigational aids in the area showed the equipment to be operating properly and that he continued to call until notified of the accident. He added that just prior to the blip enlargement, the two returns appeared to be one quarter of a mile apart.

Charles W. Carmody, assistant director of the CAB's Office of Air Traffic Control, identified the radar in use as surplus MEW Air Force equipment utilizing a high and low beam with a practical range of 70 mi. Effective range of the low beam used for incoming traffic from the west is about 36 mi. This installation, which he termed "obsolete," will be replaced by Sept. 1 with a new long-range radar having twice the range of present equipment.

He told the panel, however, that while the more powerful unit will produce a better radar picture, it will be "subject to limitations" in relation to its ability to return signals from jet aircraft. Carmody explained that the whirling propeller patterns of piston engine planes make "excellent" targets for radar beams. The absence of such patterns from jet aircraft creates a target much more difficult to detect on a radar screen.

Most military jet aircraft handled by air traffic controllers are equipped with radar beacon transponders which extend radar coverage and provide speedy automatic identification, he pointed out.

A study of the wreckage by CAB investigators indicated that the angle of collision between the aircraft was 45 degrees horizontal with evidence that the Viscount was struck while the T-33 was ascending. John F. Pahl, testifying as chief of the CAB's Structures Group in the investigation, said the T-33's vertical angle had not yet been determined.

Impact Area

Pahl said the right wing pod of the jet struck the Viscount fuselage between the number two engine and a point to the immediate rear of the cockpit.

Neither number one nor two engine props bore any evidence of damage due to collision as compared with deep metal cuts on the starboard propellers.

While the investigator stated that the findings of his group have not been fully analyzed, representatives of the Air Line Pilots Assn. and Capital said they felt the lack of collision damage to port side propellers is a clear indication that the jet overtook the airliner while climbing and then banked into the Viscount.

McCoy explained that he had taken Pvt. Chalmers aboard for an indoctrination flight in the hope of interesting him in flight training. Flying VFR in clear weather conditions, he said he descended from 8,000 to 5,000 ft. to enable Chalmers to snap pictures of the "scenic countryside." He said he then made a 180 degree turn and planned to climb to 9,000 ft. with a descent in the Baltimore area. He added that all banks were kept to less than 30 degrees for the comfort of his passenger.

McCoy was unable to recall his air speed or rate of climb at the time of the accident but estimated his power setting

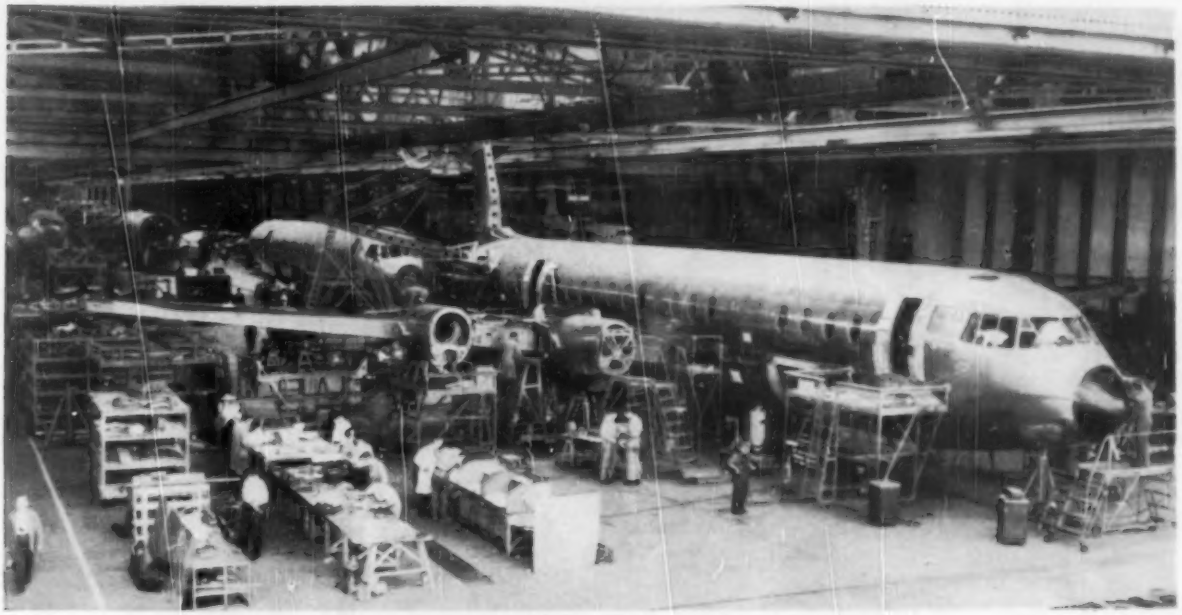
New TWA President

Los Angeles—Former Secretary of the Navy Charles S. Thomas, was elected president and a director of Trans World Airlines last week, succeeding Warren Lee Pierson who has served as acting president since Carter Burgess resigned as the top official late last year (AW Jan. 6, p. 40).

Thomas was named Navy Secretary in 1954 and served in that position for three years. During World War II, he served as special assistant to Navy Secretary James Forrestal and was in charge of all procurement of naval aircraft.

From 1937 to 1952, he was president of Foreman & Clark, a men's clothing chain. In 1953, he was appointed Under Secretary of Navy and, later that year, he was named to the newly-created office of Assistant Secretary of Defense for Supply and Logistics.

Thomas will take over his new duties immediately at TWA's New York headquarters.



Vanguard Turboprop Transport Nears Completion

First Vickers-Armstrong (Aircraft) Ltd. turboprop Vanguard transport is shown on final assembly line at Weybridge, England. Pressurized production aircraft, which will include all systems, is expected to make first flight this fall. In background is the first of 20 Vanguards ordered by British European Airways (AW Sept. 2, p. 76). Almost all airframe components of the first Vanguard have been fabricated and most have been fitted. Systems testing and installation is almost completed. Resonance tests will begin in about a month. Front and rear passenger compartments of Vanguard No. 1 are being fitted with BEA furnishings. Rest of passenger cabin will contain observation and recording equipment which is being pre-assembled on a false floor, a procedure designed to simplify installation.

Electra Performance Evaluated in Mexico

Mexico City—Lockheed Aircraft Co. and Eastern Air Lines test crews brought Lockheed's first production model of the turboprop Electra here for high altitude landing and takeoff tests at International Airport.

Tests were made after a week of an extensive testing tour of the United States, which included Electra's first non-stop flight from Burbank, Calif., to Norfolk, Va.—flight time was 6 hr. 18 min. (including 20 min. traffic delay near Norfolk).

Lockheed flew the Electra to Norfolk for several days of tests for the Navy which will use it as anti-submarine warfare aircraft.

Eastern will get 40 Electras and plans to put some of them on its Mexico City-New York run some time next year. Aeronaves de Mexico also plans to buy three Electras and Compania Mexicana de Aviacion is interested in the aircraft.

Tests were under supervision of Herman Salmon, Lockheed's chief engineering test pilot. Test group included engineers from Lockheed, Eastern personnel and General Motors Allison Division engineers.

Engineers said the Electra did better than was expected on takeoff power at the high altitude (7,300 ft.) and medium to high temperature. They added that the Electra averaged 2,900 eshp. on takeoffs; it was only expected to develop 2,500 to 2,600 eshp.

Electra arrived from Indianapolis; flight time was 4 hr., 53 min. (which included skirting some heavy weather just inside Mexico's border).

Eastern officials said that expected flight time from New York to Mexico City with Electras will be about five hours.

Crews reported that International Airport runway was somewhat rougher than expected.

The Electra picked up considerable tar-spray after wheels hit some recently filled chuck-holes (tar and gravel compound).

For demonstration purposes, landings were made in an area of around 1,000 ft. with ground idle pitch on the propellers and very little reverse thrust.

A simulated wave-off was made at Mexico's City's high altitude strip with wheels almost touching at 110 kt. landing speed. Similar tests were made at Acapulco on the Pacific Ocean (sea level). Maximum landing load for Mexico City was estimated at 95,650 lb.

Test loads averaged 76,000 lb. Test takeoff loads were made at 79,000 lb. gross weight. Maximum gross weight at sea level is 113,000 lb.

Air Transport Assn. Scored on High Fares

Washington—Senate Small Business Committee's Chairman, Sen. John Sparkman (D.-Ala.), charged in a floor speech that the air transport industry "is on its way to creating its own man-made depression" with high fares which will cut back volume business.

"As each of the new, veteran-owned postwar independent carriers grew and flourished in the new coach market which they pioneered, it was systematically grounded by Civil Aeronautics Board edict," Sparkman protested. "That competition was the oxygen of the new air transport industry and that oxygen was cut off by the monopoly practices fostered by both the major air carriers and the CAB itself."

He said the Board recently acceded to a 6.6% across-the-board fare increase because "the pressure was terrific."

"Sealed off from competition, the big airlines' demand for a fare increase was the classic next step," the senator declared.

Sparkman urged CAB to "protect the aviation companies from their own doctrine of scarcity." Otherwise, he anticipated, "they will turn to the Treasury for subsidy, pleading, no doubt, that their new plush jets are a national defense asset."

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CUBIC CONTENT: *.035 cubic inches.* **ELECTRICAL RATING:** *5 amps-250 vac, 30 vdc. SPDT.*

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This new "SX" basic switch represents an entirely new set of answers to the space-weight problems in dependable precision switching. It combines new small size with more than ample capacity for wide usefulness, meeting the pressing demand for miniaturization combined with reliability.

In its exacting development, many problems of design, testing and quality control presented themselves. However, 23 years of experience proved of immense value. As a result, a new standard has thus been set by which all precision switches must be measured.

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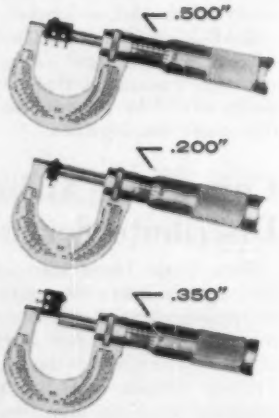

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SHORTLINES

▶ **Alitalia,** the national airline of Italy, has announced it will inaugurate new service from New York to Karachi and Bombay via Rome on Nov. 1, 1958. The new flights will be operated twice weekly in each direction with one flight operating Rome-Athens-Karachi-Bombay and the other Rome-Teheran-Karachi-Bombay. Douglas DC-7C aircraft will fly the New York-Rome segment with Douglas DC-6B airliners operating from Rome to the Asian cities. Combination first class, tourist and economy class seating arrangements will be used. Alitalia also plans service to Japan and Australia next year and is negotiating for additional service at specific U.S. points.

▶ **Douglas Aircraft Co.** has delivered its 1,000th airliner of the DC-6 and DC-7 series. The latest DC-7, manufactured for United Air Lines, is the 57th such plane delivered to the airline and the 151st DC-6 and 7 series airliner placed in service by United.

▶ **Eastern Air Lines** has awarded seven contracts for 527,800,000 gal. of turbine fuel to run its fleet of turboprops and turbojets the next three years. The seven oil companies are: Cities Service Petroleum, Esso Standard Oil, Gulf Oil, Shell Oil, Sinclair Refining, Standard Oil of Ohio and The Texas Co.

▶ **Flying Tiger Line** has been awarded a three month $3 million contract by the Military Air Transport Service to be its prime contractor on Pacific operations. The contract calls for passenger and freight service between the U. S. mainland and various points in the Far East, chiefly Tokyo.

▶ **Icelandic Airlines** says its entire schedule of 28 flights during June between the U. S. and Europe departed with a 100% passenger payload. The airline also announced that passenger loads on eastbound flights for the first five months of 1958 were 42% higher than the same period last year.

▶ **Pan American World Airways** has announced the award of a contract for the construction of its $8 million terminal at New York International Airport to the Turner Construction Co. of New York. The airline said work will start immediately and will be completed sometime in the fall of 1959. Pan American also announced it flew 1,360,000 lb. of cargo eastbound from the U. S. to Europe in the first four months of 1958, an 18% increase over the same period last year.

AIRLINE OBSERVER

▶ Airline common stock prices, which continue to show strength by holding close to 1958 highs, are viewed by many brokers as "illogical" in the light of discomforting news that second quarter results may show no signs of recovery from the current traffic slump. However, a number of brokers feel that even the threatened discontinuance of dividend payments by some carriers will not discourage investors who are looking at the growth factor of those companies about to introduce jet transports.

▶ **Domestic airlines are now convinced that the current traffic slump coupled with the imminence of jets and a resulting increase in available seat miles is already outdating material presented thus far in the general passenger fare investigation. Industry fears that the Civil Aeronautics Board will be required to rest its decision early next year on facts that will no longer be relevant because of the rapidly changing face of air travel.**

▶ Russia expects to increase the payload of its new jet and turboprop transports by as much as 1,000 lb. through the use of newly-developed, lighter, heat-insulating materials. Replacement of former material with "ultra-fine" glass fiber will cut the weight of a twin-jet Tu-104 by 800-1,100 lb., according to Soviet reports. Weight of the turboprop Il-18 will be reduced by as much as 440 lb. by the substitution. Filaments of the ultra-fine fiber are 1-2 microns in diameter and an even lighter, "super-fine" will "soon be made available to Soviet plane builders."

▶ **Agreement between scheduled airlines and Military Traffic Management Agency to continue the 10% discount for military transportation through June 30, 1959, has been approved by the Civil Aeronautics Board. However, the Board reserved the right to eliminate the discount clause if the present investigation of military tariffs and agreements with the airlines show that the discount is not in the public interest.**

▶ Military services have agreed to defer a self-imposed requirement of maximum use of full IFR climbs and descents and flights below 10,000 ft. on all military aircraft. Civil Aeronautics Administration, admitting that such a practice would provide a greater degree of protection for all users of the airspace, emphasized that the increased demand for IFR services would overload present air traffic control capacity. Therefore, the CAA asked the military services to confine IFR operations to airways and in controlled airspace between 10,000 and 20,000 ft.

▶ **Increase in available seat miles offered by domestic trunklines continued to level-off during May. Available seat miles produced in May totaled 3.49 billion, a 5% increase over the same month last year. In May 1957, increase was 17.9%. Percent of increase in available seat miles for the year ending May, 1958, was the lowest since November, 1956.**

▶ Czechoslovakia has begun delivery of a "large number" of twin-engine Super Aero-45 light transports ordered by Russia's state-owned airline, Aeroflot. The planes, powered by 105-hp. Walter Minor 4-111 engines, carry a pilot and three passengers. Soviet reports say that Aeroflot crews are now being checked out in the first two of the Super Aero-45s received by the Russian carrier.

▶ **Chicago Helicopter Airways has asked the Civil Aeronautics Board for a temporary mail increase for the period April 6, 1956 to March 31, 1958. The carrier is asking for the increase to cover break-even need and interest charges incurred from loans for the purchase of equipment.**

▶ Congressional legislation granting statehood to Alaska is not likely to bring about any major changes in the status of Alaskan airlines. Civil Aeronautics Board is now studying legal aspects involved but most observers feel that, outside of redesignating the carriers from a territorial category to a local service class, the carriers will continue to operate as they do now.

▶ **Hearings on proposed Federal Aviation Agency were concluded by House Commerce Transportation Subcommittee last week. Bill is expected to be reported out by the Commerce Committee without undergoing any revisions that would result in substantial differences from the Senate companion bill.**

Feats of Hercules No. **5**

FROM THE SNOWS OF FUJIYAMA TO THE SANDS OF FLORIDA

The Lockheed C-130 HERCULES, now in service with the United States Air Force at Ashiya Air Base, Japan, won its "go anywhere, haul anything" reputation the hard way.

In snow landing and take-off tests at Bemidji, Minnesota, the "Ski-130" HERCULES performed prodigious feats of strength and power. At 124,000 pounds gross take-off weight the ski-equipped HERCULES was airborne in 2,100 feet. Carrying the same payload it landed and stopped in only 1,200 feet.

At Eglin Air Force Base, Florida, the C-130 HERCULES (weighing 110,000 pounds) landed on sand and stopped in 947 feet. Take-offs from sand, with the same load, averaged only 1,500 feet.

This famous aerial "strongman" can carry 90% of all types of missiles now operational with, and under development for, the U.S. Armed Forces. The C-130 HERCULES is now in world-wide service, or scheduled for delivery to: USAF's Tactical Air Command, U.S. Air Forces-Europe, Pacific Air Force, Air Photo and Charting Service, other branches of the U.S. Armed Forces, and the Royal Australian Air Force.

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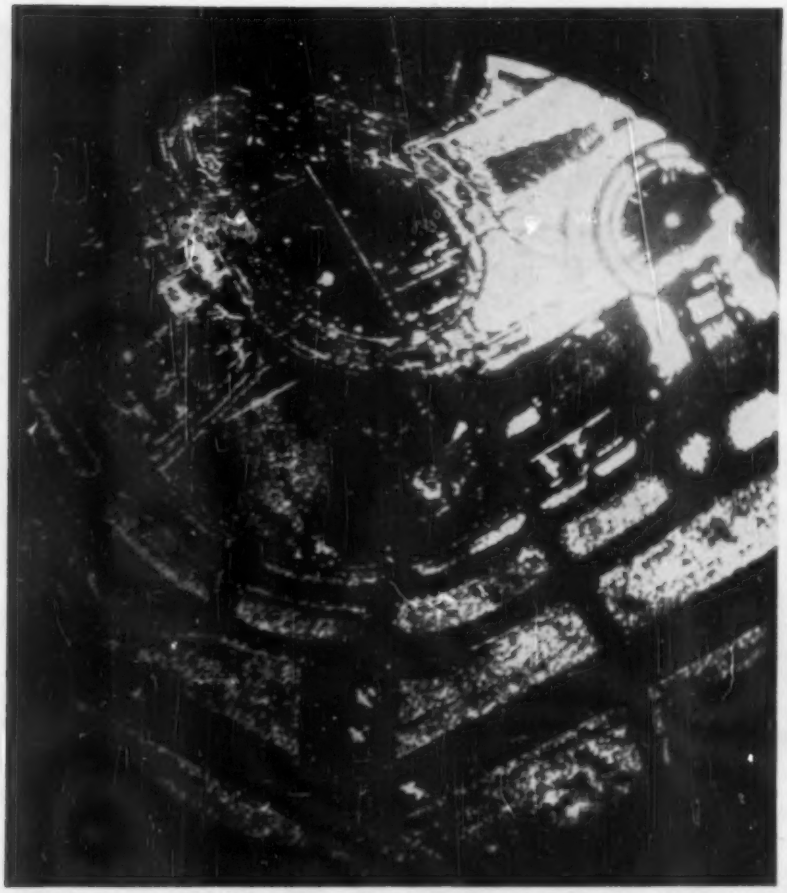

GROUND traffic at N. Y. International Airport is surveyed by Airport Surface Detection Equipment radar now under evaluation. Three aircraft are seen waiting for takeoff clearance (lower center); one aircraft has landed (lower left) and is being taxied off the runway.

Idlewild Radar Surveys Taxiways

New York—Ground traffic at New York International Airport is under surveillance by an improved Airport Surface Detection Equipment radar recently installed in Idlewild's control tower for Civil Aeronautics Administration use and evaluation.

The narrow-beam "taxi radar" provides a high-definition picture on its scope to give controllers an exact fix on each aircraft or any individual piece of vehicular ground equipment on a runway or taxiway. Bad-weather traffic control is speeded by this information, because controllers need not wait for radio reports to be sure that aircraft or vehicles have cleared active runways.

Portraying the entire landing and terminal area on its scope, the ASDE enables controllers to direct all taxiing and other ground movement with maximum accuracy.

ASDE's maximum range is four miles, although it usually scans an area of only two miles around the tower. Its resolution is such, according to Airborne Instruments Laboratory, the manufacturer, that two men standing at arms length 1,500 ft. from the tower will appear as two distinct splashes of light on the scope. If the perspective is right, an aircraft will appear so clearly that a Constellation can be recognized by its three vertical stabilizers, and two-engined planes can be distinguished from four-engined types.

Airborne Instruments, which recently became a division of Cutler-Hammer, Inc., installed its first experimental ASDE at Idlewild in 1952, after development began in 1949 under Air Force contract. The present set is owned by Airways Modernization Board. The manufacturer so far has one order—under negotiation with the Air Force—at a price of about $250,000. CAA's evaluation at Idlewild is expected to be completed in about nine months.

The Idlewild ASDE antenna is mounted at the top of the 187-ft.-high tower and enclosed in a polyethylene-coated, inflated dacron bag. Beam is 0.25 deg. in width, which the manufacturer says is the narrowest beam used in any present radar. Frequency is 24,000 mc.

Half-power beamwidth of the high-resolution radar is 15 ft. at 3,000 ft. from the antenna and physical length of the pulse is 13 ft. At the same distance, the ASR-3 surveillance radar's respective dimensions are 185 ft. by 250 ft.

SAS Picks Up Option For More Caravelles

New York—Scandinavian Airlines System has picked up its option on six additional Sud Aviation Caravelle jet transports, bringing to 12 SAS's firm orders for the twin-engined planes. Options remain on 13 more Caravelles for SAS.

The airline expects to put its first six Caravelles into European and Middle East service next year, probably in a 70-passenger mixed configuration. The second six are scheduled for 1960 delivery. Total price tag for the firm orders is $40 million.

N. Y.—San Francisco 707 Flights Planned

New York—American Airlines will offer two daily roundtrips between New York and San Francisco with its Boeing 707 jets in December if Civil Aeronautics Board grants nonstop rights for the route, the airline has advised CAB.

Frequencies would be increased to three daily nonstops within six months after initial service, American said. Both first class and coach accommodations are planned.

Although the airline did not say so, all flights probably will be in dual configuration at least during the early stages of jet operation.

American plans to inaugurate New York-Los Angeles jet service around the same time.

KLM, Aeroflot Plan Reciprocal Service

KLM Royal Dutch Airlines and Russia's Aeroflot will begin weekly services between Amsterdam and Moscow next month under an agreement reached between the Netherlands and the Soviet Union.

The Dutch carrier's DC-6Bs will serve Moscow via Warsaw, while Aeroflot Tu-104A jet transports will fly direct between the two capitals. Service will be increased to twice-weekly flights by each airline in the summer of 1959. Initial schedules are planned on July 21.

Airline Income & Expenses-First Quarter 1958

(IN DOLLARS)

	Passenger Revenue	U. S. Mail	Property	Charter	Federal Subsidy	Total Operating Revenues	Total Operating Expenses	Net Income (Before Taxes)
DOMESTIC TRUNK								
American	61,269,650	1,606,862	5,916,517	25,373	.....	69,205,865	67,441,696	2,846,709
Braniff	13,019,669	368,384	692,908	61,918	.....	14,198,552	13,521,890	756,787
Capital	22,012,169	531,117	728,676	17,127	.....	23,444,104	24,114,509	−1,468,719
Continental	5,257,981	124,466	239,493	3,399	.....	5,688,367	5,934,268	−512,604
Delta	19,690,633	440,079	1,293,248	32,251	.....	21,505,441	21,346,986	−134,189
Eastern	61,423,842	1,005,543	2,480,140	14,189	.....	65,326,305	60,735,668	4,893,010
National	15,597,473	293,501	958,238	63,803	.....	17,028,826	15,823,747	992,370
Northeast	5,329,936	100,985	251,079	12,950	.....	5,719,913	7,071,000	−1,485,528
Northwest	10,760,727	408,124	1,015,079	17,209	.....	12,340,485	14,449,598	−2,054,064
Trans World	42,317,937	1,079,178	2,306,787	75,921	.....	47,034,799	52,624,275	−6,250,078
United	55,123,909	2,388,493	4,531,532	319,585	.....	63,350,245	63,998,093	−1,009,500
Western**	5,757,936	154,081	248,520	15,363	.....	6,126,339	6,945,661	23,354
INTERNATIONAL								
AAXICO	.....	5,226	383,619	1,443,819	.....	1,832,693	1,520,736	311,957
American	1,571,159	9,908	224,858	.....	.....	1,851,538	1,664,625	186,770
Braniff	1,749,400	26,469	199,102	.....	.....	2,024,023	2,033,081	7,309
Caribbean-Atlantic	582,808	6,384	21,761	3,819	.....	627,138	507,418	119,708
Delta	1,487,883	14,907	92,579	5,881	.....	1,607,958	1,389,985	198,581
Eastern	4,628,192	108,622	170,228	.....	.....	5,454,180	4,518,705	917,067
Mackey	329,946	.....	7,446	1,480	.....	339,925	378,227	−23,913
National	1,205,410	11,470	81,125	14,785	.....	1,314,728	1,186,931	125,083
Northwest	3,992,780	1,458,844	774,660	5,924	.....	6,439,141	6,261,642	154,601
Pan American								
Alaska	486,580	41,118	113,839	.....	.....	626,416	1,172,215	−332,782
Atlantic	18,111,809	1,870,005	2,783,994	697,953	.....	24,619,121	29,531,599	−4,860,714
Latin America	17,480,747	533,758	3,635,798	253,296	.....	22,448,983	23,745,813	−1,233,121
Pacific	11,708,276	1,360,427	1,819,398	1,172,728	.....	16,612,994	17,237,780	−147,417
Panagra	3,683,317	131,344	617,166	41,407	.....	5,039,270	4,774,823	260,604
Resort	.....	.....	.....	1,378,621	.....	1,482,914	1,321,022	164,160
Trans-Caribbean	123,023	.....	.....	18,313	.....	170,088	196,736	−36,521
Trans World	8,828,114	1,290,080	932,974	630,181	.....	12,509,255	17,087,044	−4,808,769
UMCA‡	18,165	.....	4,115	.....	.....	22,307	32,219	−9,912
United	2,522,461	97,709	61,525	72,000	.....	2,793,667	2,724,283	35,907
Western**	283,295	305	5,125	.....	.....	290,502	352,766	−72,491
LOCAL SERVICE								
Allegheny	1,048,908	30,602	49,752	1,675	594,822	1,733,160	2,188,032	−475,491
Bonanza	685,114	9,867	28,762	1,976	398,096	1,130,215	1,101,170	29,685
Central	369,829	9,935	17,230	4,771	708,327	1,116,505	1,088,677	24,804
Frontier	948,862	29,118	80,988	18,782	590,300	1,678,872	1,736,154	−63,502
Lake Central	432,589	12,060	16,126	3,342	442,044	907,286	956,990	−57,681
Mohawk	1,232,844	13,746	52,687	18,857	530,134	1,858,874	2,145,862	−312,611
North Central	1,836,925	55,822	42,555	62,376	606,203	2,609,630	2,999,571	−402,368
Ozark	1,071,225	28,597	47,083	13,322	658,289	1,824,173	1,887,596	−77,963
Pacific	1,002,287	28,096	23,953	19,035	436,683	1,514,055	1,660,393	−166,868
Piedmont	1,184,915	23,469	34,942	13,768	613,317	1,920,605	2,086,750	−169,642
Southern	585,537	22,297	233,345	2,207	483,315	1,121,777	1,235,185	−116,284
Trans-Texas	779,822	28,209	46,801	11,962	729,082	1,609,729	1,626,793	−23,032
West Coast	624,117	10,731	17,333	6,923	438,851	1,100,857	1,206,381	−31,021
HAWAIIAN								
Hawaiian	927,902	9,149	160,301	1,547	.....	1,113,016	1,336,294	−246,144
Trans-Pacific	379,179	1,955	21,919	662	24,460	451,108	546,007	−99,012
CARGO LINES								
Aerovias Sud Americana	.....	.....	376,221	84,511	.....	470,721	478,730	−12,302
Flying Tiger	.....	30,021	2,423,697	4,426,608	.....	6,810,185	7,436,215	863,987
Riddle	.....	16,498	1,025,398	1,208,323	.....	2,260,950	2,972,180	−872,155
Seaboard & Western*	.....	.....	.....	.....	.....	.....	.....	.....
Slick	.....	16,657	491,877	957,546	.....	1,501,431	2,550,967	−301,432
HELICOPTER LINES								
Chicago Helicopter	102,436	13,650	1,277	.....	290,901	408,360	444,371	−39,487
Los Angeles Airways	37,322	29,100	15,299	714	233,250	315,915	295,800	20,366
New York Airways	113,817	10,748	10,650	4,236	395,872	548,191	596,710	−48,574
ALASKA LINES								
Alaska Airlines	327,926	114,907	105,828	207,949	522,723	1,318,088	1,309,008	−2,176
Alaska Coastal†	122,902	25,160	23,633	3,036	86,553	264,090	336,001	−76,084
Cordova	17,913	23,633	9,328	19,990	141,683	225,162	219,135	6,062
Ellis	79,880	12,760	11,770	3,481	66,309	117,996	255,043	−83,851
Northern Consolidated	127,430	83,715	73,769	28,308	197,991	508,407	535,985	−27,660
Pacific Northern	898,222	164,461	176,761	5,931	697,622	1,964,449	2,105,107	−184,477
Reeve	133,291	77,660	53,985	93,119	.....	366,428	382,760	−17,487
Wien Alaska	113,198	112,483	53,605	142,288	305,993	736,728	833,757	−105,427

* Not available. ** Western Strike 2/21/58–6/1/58. † Alaska Coastal a partnership—no taxes. ‡ Uraba, Medellin & Central Airways.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

in airline service

PROTEUS POWERS THE RECORD-BREAKING BRITANNIA. The Bristol Proteus is the most powerful, most advanced jet-prop in commercial operation today—approved without restriction for use in passenger-carrying commercial aircraft. The Proteus is the first axial engine to reach the airlines of the world.

It is installed in the Bristol Britannia—currently setting new standards of vibration-free comfort on record-breaking transatlantic and Mexico City–New York schedules.

Unique advantages. The Proteus is unique in having the Bristol-pioneered free-turbine system. This system gives high efficiency over a very wide range of operating conditions with a low specific fuel consumption—lowest of any gas turbine in service, military or civil. In addition, because it allows low propeller speeds, the free-turbine system results in an exceptional degree of quietness . . . starting is easier and control systems are greatly simplified.

Magnificent reliability. The Bristol Proteus has a magnificent record of mechanical reliability. The 705 version started airline operation with an overhaul life of 500 hours. As a result of its performance in service, the overhaul life has already been officially extended to 1,300 hours—in just thirteen months of operation—the most rapid increase in airline history.

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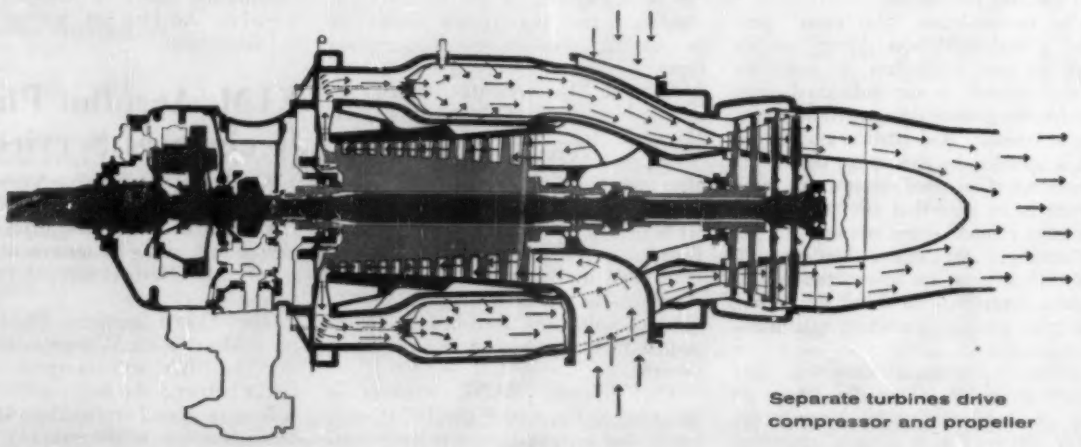

Separate turbines drive compressor and propeller

Honeywell's RAM a NEW 2-axis gyro designed to withstand missile shock and vibration.

Maintains tight accuracy under high acceleration and severe vibration. This hermetically sealed displacement gyro is smaller and lighter than its predecessors. It was especially designed and has been sled-tested for missiles and advanced aircraft.

Specifications:

Gimbal Freedom: ±85° in pitch and 360° in roll.

Precession Rates: Varying from 6°/min. to 8°/sec. according to customer requirements.

Drift Rate: Free drift rate is within 2°/min. during vibration of 0 to 2000 cycles at 15g's.

Shock Resistance: Designed to withstand 80g's shock.

Electrical Ratings: Torque motors operate on 115v, 400 cps., two-phase.

Angular Momentum: 1.5×10^6 to 3.25×10^6 gm-cm²/sec. (Per customer requirements.)

Rotor Speed: 24,000 rpm.

Size: 4½ x 4½ x 5½ inches.

Weight: 4.5 pounds.

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Honeywell

Military Products Group

Drag Devices May Aid Satellite Recovery

By Richard L. Sweeney

Los Angeles—Use of variable area drag devices such as metal parachutes is being proposed as a way to reduce aerodynamic heating and acceleration in satellite recovery.

Deeming use of drag devices as currently possible, Richard Hoglund and Dr. J. Thale of the Cook Research Laboratories, dealt with recovery in three phases at a recent meeting here of the American Rocket Society.

These are:

- **Passage** from an outer orbit to a final orbit altitude approximately 60 mi. above the earth's surface.
- **Re-entry** through the earth's atmosphere and descent to an altitude at which final recovery may be initiated.
- **Final recovery,** that is, deceleration of a vehicle to a speed suitable for land or water impact.

Use of thrust to alter the original orbit trajectory was projected; fuel weight saving is estimated at 150 lb. if a single impulse is used to depart a 200 mi. orbit and drag is used to establish the final orbit at 60 mi., rather than use of retrothrust to depart from the original orbit and enter the 60 mi. one. Thrust is used advantageously to reduce vehicle kinetic energy, applied tangentially.

Change to Final Orbit

Changing from original to final orbit by steeper angles will, if decelerations are tolerable to the satellite cargo, have advantages of cutting aerodynamic heating, reducing range and thereby lessening possible travel distance errors.

Use of drag areas for deceleration has several aspects and varying relationships with altitude and re-entry angle. Varying the drag area to produce a constant deceleration of 4Gs, is most practical.

Example used was based on satellite conditions at 300,000 ft., with a maximum effective drag area of 3,800 sq. ft., varying to 500 sq. ft. minimum, with a vehicle effective drag area of 80 sq. ft. The required variations, the paper states, could be achieved through a system of continuous reefing and letting out of a parachute.

Stagnation point temperatures pose a most severe problem on most configurations, and here again, use of retrorockets to descend to final orbit altitude would be best in their reduction of exposure to heat time, rather than use very large drag areas, which still would require many revolutions to drop from original orbit altitude and speed to final one.

However, the paper indicated, descent from 450,000 ft. to 300,000 ft. using a very large drag device would reduce heat inputs and surface temperatures.

Drag Devices

Among conventional drag devices, parachutes appear to be the only feasible items for large drag areas, the paper indicated, requiring the least weight for a given drag area. Although little is known of deployment at high Mach numbers and low densities, inflation problems should be lessened since centripetal force supports parachute weight, and extension could be effected by a rubber or plastic tube attached to the skirt.

A metal gore parachute could be extended by a series of springs attached between adjacent gores.

The paper added that these artificial means of inflation may not be needed, since it has been reported that in Russian tests, self inflations have occurred as high as 40 mi.

Calculation of temperatures to be encountered by the parachute material show them to be well above those of nylon, leaving three possible avenues of approach: use of heat sink type material, use of ablation type material, or use of material which can withstand the surface equilibrium temperatures, with the last being the most practical. Use of thin metal strips or woven metal cloth for the ribbons was projected.

The paper also stated that due to the very high velocities (and resultant high temperatures) and low densities at which parachute operation is contemplated, a sizable fraction of the air will exist in an ionized state. The air is thus a conductor of electricity. This makes it appear possible that the flow field may be influenced by magnetic fields (created by the parachute), resulting in increase of total drag while decreasing heat transfer.

Use of magnetic fields in combination with conductive metal drag area construction might play a very important part in variation of drag area, the paper indicated.

Estimates on weight of a variable area drag system would be on the order of 175 lb. This is based on a system using thin, high-temperature-resistant steel plates and preprogrammed reductions or reductions controlled according to sensing of given aerodynamic loads, with an area reduction ratio of 5 to 1.

After the variable area drag device has decelerated the vehicle and reduced its altitude sufficiently, deployment of a conventional parachute at speeds of less than Mach 1.5 would accomplish final recovery after suitable impact speed has been reached. Use of a high drag vehicle configuration is deemed most desirable to avoid resorting to a complex reefing parachute system for this final recovery.

A paper by Dr. Eberhard Rechtin of Jet Propulsion Laboratory outlined a number of unexpected occurrences in connection with satellite tracking.

First unexpected occurrence, according to Rechtin, was the appearance of a Russian satellite instead of a U.S. satellite.

Use of 20 and 40 mc. instead of the U.S. 108 mc. frequency was for propaganda effect and study of the ionosphere, with several strange effects in the ionosphere area being noted. Radio waves would get trapped under ionosphere layers, resulting in stations considerably removed from the satellite path being able to hear the signals for considerable lengths of time, with reports spanning from one half hour to an hour and a half.

Precursor Noted

Another effect was appearance of a precursor, a low level signal appearing about 30 sec. before the start of the main satellite signal. These precursors could be tracked by interferometers or other tracking devices and, coupled with speed knowledge, enabled observers to tell if the satellite signal was emanating from a satellite overhead or one removed from the receiving center and the signal arriving by bounce or being trapped by one of the several reflecting layers.

One remote reception which gained wide attention was the so-called "ghost satellite," a condition in which signals appearing to be from the satellite itself, including production of the proper pattern when an interferometer was used to track the signal, occurred when the satellite actually was 180 deg. around the earth. Possible explanation is that the radio waves were trapped in a rather peculiar way by the ionosphere such that they reached the listener in precisely the right phase. The phenomenon was observed at 40 mc.

Another ionospheric effect made it appear as if the vehicle was spinning or tumbling. Effect would have been real except that spin rates would change

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within a given pass, would change from pass to pass, resulting in ground effect of putting deep fades into signal at periodic intervals. Periods of between 15 sec. and 15 milliseconds were observed, and rate of period increase depended on whether or not Sputnik was approaching the magnetic pole or traveling parallel to it.

Additional confusion was created by an unknown telemetry type aboard the Russian satellite, with frequency modulation appearing on certain of the Sputnik II passes.

Signals received from Explorer I also turned out not as expected. Expected to produce a relatively constant signal with small modulation due to spin, the satellite signal instead developed fades which increased in depth from injection into orbit for several days until they reached a relatively stable condition some days later.

It developed that Explorer motion was affected by antennas, that spin around the longitudinal axis gradually turned into propellerlike roll creating signal change. Explorer I's original path had a spin like a rifle bullet, wound up like a propeller.

The Rechtin paper also indicated that a faith is best maintained in instruments sent into space. Illustrating his point were the data sheets received from Nairobi and Singapore where results indicated instrumentation was malfunctioning.

Later it was ascertained that in these areas the data was correct, but that this was where the heavy electron layers were being encountered and Geiger tube saturation was occurring. The original findings from Explorer I were verified by Explorer III.

Another strange occurrence of Explorer I was the resurgence of a dead transmitter, one projected to operate for 13 days at 50 mw. After performing as scheduled, the transmitter was again heard from for 23 to 27 days at the 10 mw. level. The conclusion, according to Rechtin, is that after a life test has been completed, keep testing for a long time—it may come back to life unexpectedly.

A system for landing delicate instrumentation on the surface of the moon by using inflatable, large-diameter spheres with a payload in a protected position in the center was proposed by Krafft Ehricke, Convair Astronautics.

Ehricke's proposal called for use of the spheres in conjunction with a lunar satellite to which data could be telemetered back from the moon's surface. Several of the instrument landing spheres could be carried in each moon satellite, in the collapsed state, and could be inflated at the time of discharge toward the moon's surface.

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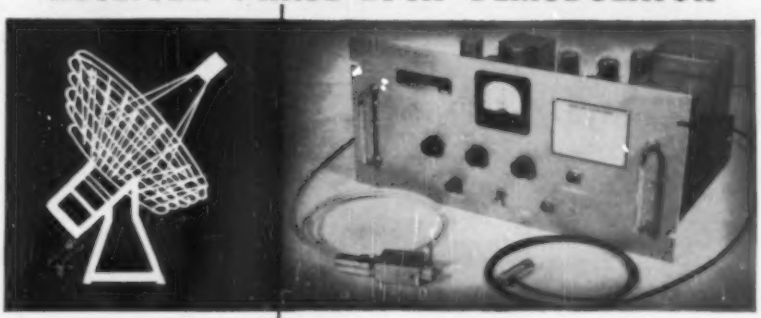

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have adequate strength for expected impact loads in an outer shell, with an interior pressure structure holding instrumentation properly suspended. Outer shell would have two shells, separated by perforated rubber rings.

Since the spheres would be from 10 to 20 ft. in diameter, according to Ehricke, they would, upon landing with some angular velocity, have the advantage of the mechanical energy being turned into heat, thereby reducing elasticity of the ball.

Ehricke's system would have spheres ejected from a satellite by breakaway rockets, followed by sphere inflation by compressed gas, with the sphere in an elliptical path around the moon which carries it near the surface. Small retrorockets would be used to reduce velocity to a level close to that of near zero relative to moon surface with sphere then descending to surface.

Use of a spherical configuration, according to Ehricke, would eliminate several disadvantages of other landing systems, such as uncertainty about actual surface, danger of losing the package in a depression or crevasse, or breaking of a nose spike if any angular velocity remains when the package touches the moon's surface.

Navy Contracts

Washington—Following is a list of unclassified contracts for $25,000 and over as released by U. S. Navy contracting offices:

AVIATION SUPPLY OFFICE, 700 Robbins Ave., Philadelphia, Pa.

McDonnell Aircraft Corp., St. Louis, Mo., radome, strut and flap assemblies, N383-52175A(383/9504-37/58), $88,853.

General Electric Co., Philadelphia, Pa., transmitters, for F4D-1 aircraft, N383-53125A(383/7144-29530/57), 475 ea., $27,118.

Aviators Clothing Co., Inc., Beacon, N. Y., jackets, winter flying, N383-53185A(JD-IFB-383-823-58), $55,305.

Airaterra, Glendale, Calif., valves for various aircraft, N383-52261A(JD 383/9043-28005 X2/1/58), $58,910.

M. Steinthal and Co., Inc., New York, parachute assemblies, chest type, personnel, N383-52261A(383/9045-22742 F1/1/58), 2,700 ea., $334,800.

Westinghouse Electric Corp., Philadelphia, Pa., modification kit assemblies, used on circuit breakers for various aircraft, N383-51135A(383/9031-28869 X2/4/58 Aero.), $103,838.

Vickers, Inc., Detroit, Mich., motors, for P2V aircraft, N383-5159A(383/9043-28773 X3/2/58 Aero.), $41,529.

Scintilla Division, Bendix Aviation Corp., Sidney, N. Y., accessory spare parts for various aircraft, N383-50276A(MIPR-33-600-7-02A-262), $29,414.

General Electric Co., Philadelphia, Pa., bearings, N383-52831A(383/6144-25586 G2/1/56), 6,680 ea., $88,710.

United Steel and Wire Co., Battle Creek, Mich., platforms, maintenance, aircraft, N383-50996A(IFB-383-332-58), $64,451.

The Goodyear Tire and Rubber Co., Akron, Ohio, main wheel assemblies for various aircraft N383-52543A(383/27420-29409/57), 301 ea., $45,508.

Douglas Aircraft, Inc., El Segundo, Calif., panels, AD4, 5N and 5W spares, N383-52178A(383/9011-210485 A4/1/58 Aero.), 286 ea., $72,158.

Master Specialities Co., Los Angeles, automatic parachute openers, N383-52982A(383/9045-22821 F1/1/58), $245,891.

Mirax Chemical Products Corp., St. Louis, Mo., metal drums, N383-692-58, 17,043 ea., $62,123.

Pioneer Central Division, BendixAviation Corp., Davenport, Iowa, vertical velocity indicators, N383(17-383)53104A(IFB-383-688-58, 1,152 ea., $153,671.

Utica Division, Bendix Aviation Corp., Utica, N. Y., starter generators, for use in various aircraft, (N383-51571A(383/26126-27213 P6/2/56 Aero.), $353,650.

Telectro Industries Corp., Long Island City, N. Y., thermometer testers, N383-52616A(JD-IFB-383-696-58), 109 ea., $30,475.

Stratos Division, Fairchild Engine and Airplane Corp., Bay Shore, L. I., N. Y., turbine assemblies, control valves and pump control assemblies for various aircraft, N383-51128A(383/6150-28942/56 Aero.), $447,283.

The Cornelius Co., Minneapolis, Minn., compressor assemblies for FJ-4 and FJ-4B aircraft, N383-52321A(383/9043-29411 X7/1/58 Aero. and 383/9043-29697 X7/1/58), $64,460.

Kett Technical Center, Inc., Pompano Beach, Fla., spare parts for actuators, Kett part No. 1235, N383-51808A(383/2118-27155 P6/2/55 Aero. and 383/2118-27267 F6/2/55 Aero.), $133,964.

Walter Kidde and Co., Inc., Belleville, N. J., Bromotrifluoromethane containers, N383-52364A(383/9043-24307 GA/1/3/58 Aero.), $46,485.

Bendix Products Division, Bendix Aviation Corp., South Bend, Ind., services to overhaul, repair and restore to first class operating condition government owned pumps, N383-50165A(383/2118-27007 P6/2/55 Aero.), 416 ea., $248,656.

Consolidated Diesel Electric Corp., Stamford, Conn., power units, N383-52221A(JD-IFB-383-617-58), 217 ea., $563,332.

AC Spark Plug Division, General Motors Corp., Flint, Mich., spark plugs, gap setting, used on engines, N383-52126A(383/9081-29641 X5/2/55), 117,450 ea., $422,820.

Henry Spen and Co., Inc., Brooklyn, N. Y., spare parts for air-nitrogen trailers, N383-52258A(383/9065-27639 S1/3/58), $218,688.

Consolidated Diesel Electric Corp., Stamford, Conn., motor generators, N383-52775A (IFB-383-606-58), 214 ea., $404,246.

Switlick Parachute Co., Inc., Trenton, N. J., pack assemblies, NB-8 regular and oversize, N383-52582A(IFB-383-698-58), 2,384 ea., $75,454.

Government Service Department, Raytheon Manufacturing Co., Waltham, Mass., spare parts, radio, for use on AN-CPS9 equipment, N383-52444A(383/3371-21734 E1/1/58 Aero.), $25,972.

Lavoie Laboratories, Inc., Morganville, N. J., radio test sets, N383(17-24-383)-52915A(383/9069-21656 E2/6/58, Lot I), (PREN 11-4643-58, Lot II), (24-75006(58), Lot III), $839,460.

Pioneer Central Division, Bendix Aviation Corp., Davenport, Iowa, maintenance parts, used on oxygen regulators, N383-52119A(383/2110-29176 X7/1/55 Aero.), $79,789.

The New York Air Brake Co., Watertown, N. Y., maintenance parts, used on pumps for various aircraft, N383-52604A(383/2150-29798/55 Aero.), $57,706.

Schaevitz Engineering, Pennsauken, N. J., pulse generators, N383-53079A(IFB-383-662-58), 300 ea., $220,500.

AiResearch Manufacturing Co. Division, The Garrett Corp., Los Angeles, Calif., services and material to repair and modify compressors, valves, and water separators, N383-50158A(383/3055-2942 X2/58), (383/2110-28002/55), $358,869.

Air Logistics Corp., Pasadena, Calif., adapters, roller, for rail type engine; airframe handling equipment, N383(17)-51608A(PREN-11-3711/58), 1,396 ea., $72,801.

The Cornelius Co., Minneapolis, Minn., maintenance parts used on compressors, N383-52514A(383/9043-29275 X7/1/58 Aero.), (383/9043-29724 X7/1/58 Aero.), $142,764.

Northeastern Engineering, Inc., Manchester, N. H., frequency meters, N383(MIS)-52401A(MIPR-33-604-8-17C-5004), $613,410.

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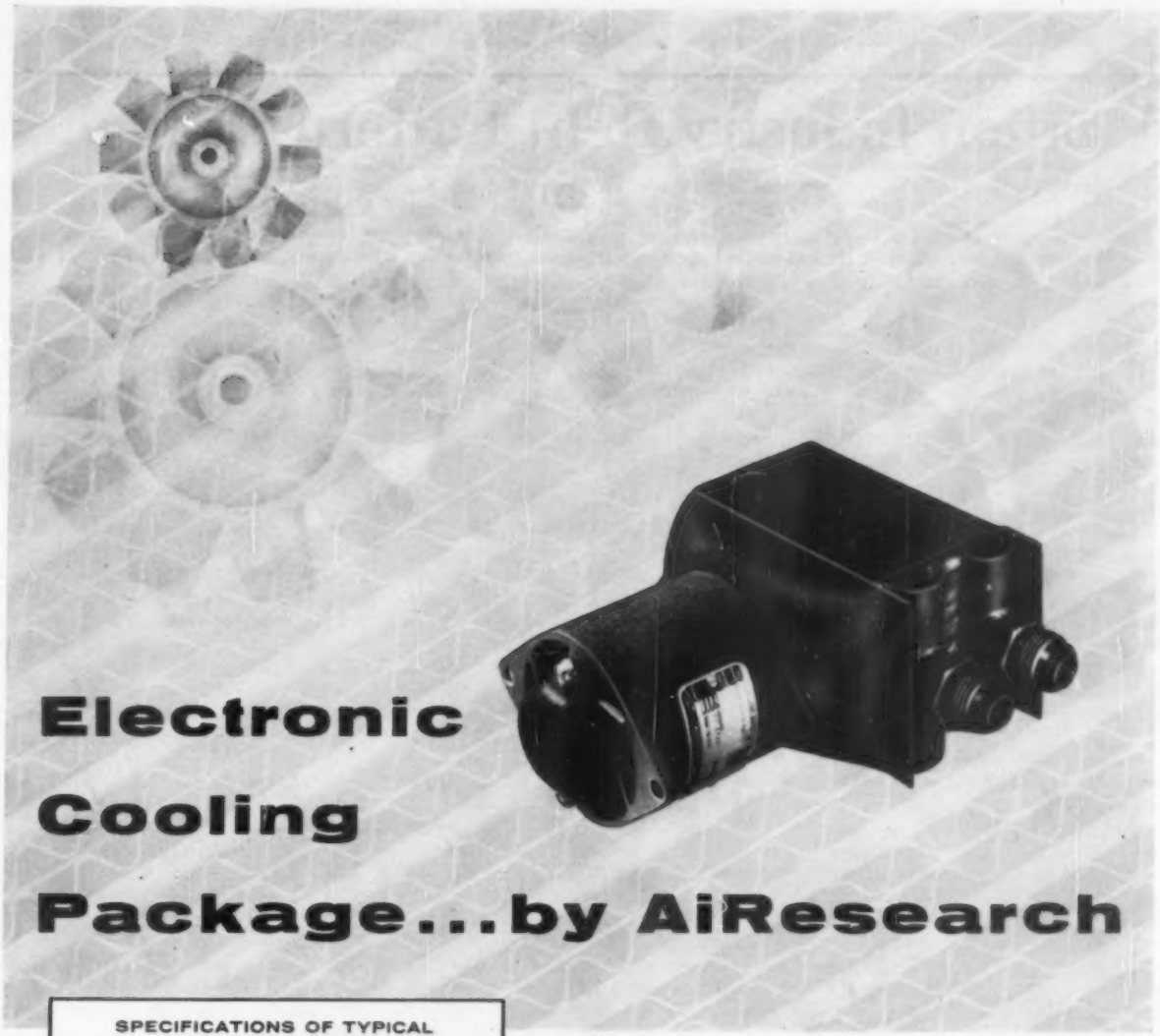

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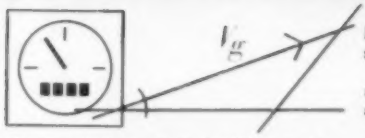

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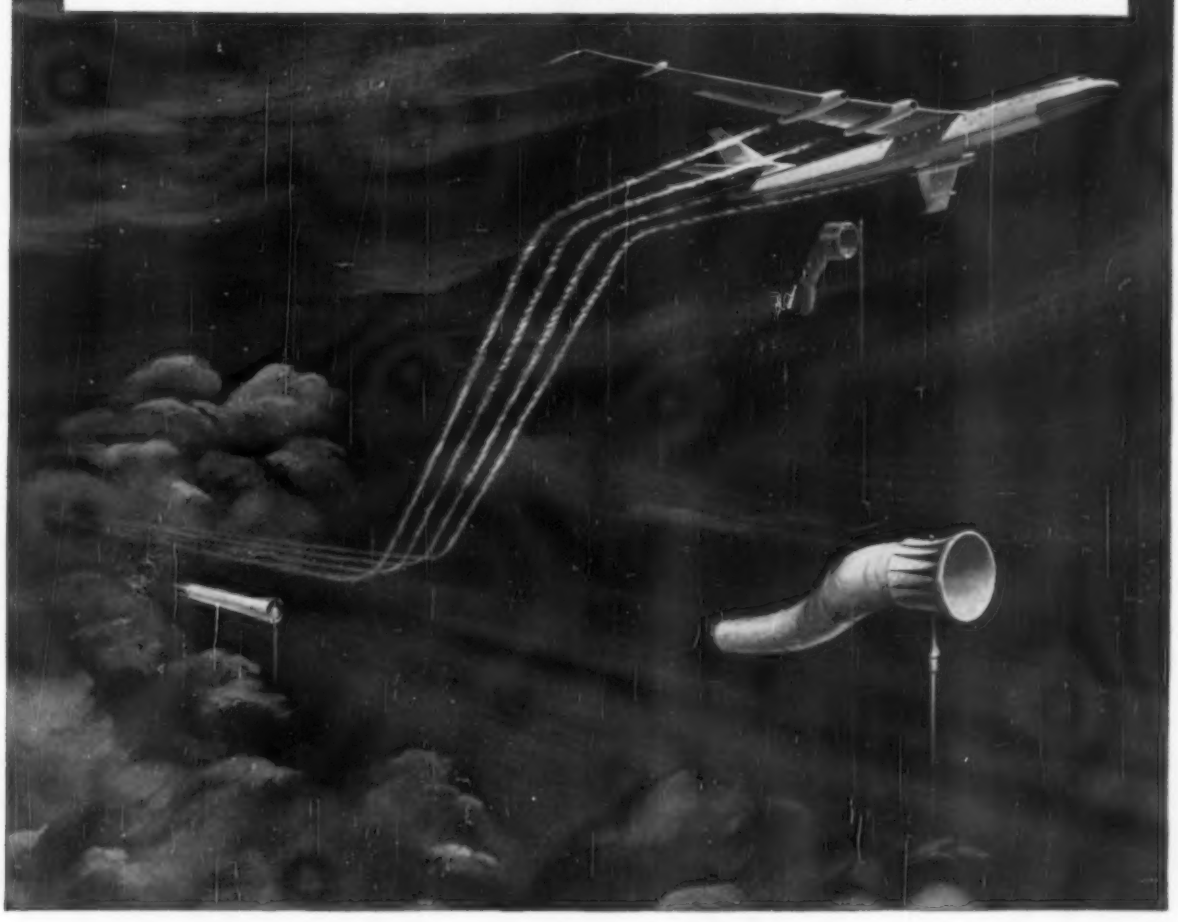

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Aviation Industry Debt Pattern Changing

By William H. Gregory

New York—Debt pattern of the aviation industry is undergoing a basic change. Not only is short term borrowing from banks rising to higher levels, but also substantial long term debt is spreading in the industry.

Boeing Airplane Co. is the latest to join the long term debt club. It will offer $30,597,000 in convertible debentures to stockholders and $60 million in nonconvertible debentures to the public this month (AW June 30, p. 22). The Martin Co. had planned to offer $20-25 million nonconvertible issue last week but delayed the offering.

An AVIATION WEEK survey and tabulation of 12 aircraft companies puts their total long term debt, including these recent issues, at $365 million, more than double the figure at the end of 1956. Short term debt for these same companies, measured at the end of 1957, was $396 million.

Because of its rapid expansion and contraction, short term debt is harder to estimate at any given time. In the unlikely event that all these 12 companies were to borrow the maximum amount of the lines of bank credit they have established, according to the latest figures available, the total would reach about $650 million. Or, combining this figure with long term debt, the total would be over a billion dollars. This figure gives some insight into what the entire industry debt situation may be.

AVIATION WEEK asked these same companies whether they considered the trend alarming. Many answered "no." Some answered with a qualified "yes," i.e., that borrowing was not alarming in itself but might be dangerous if the whole industry were to have to borrow at once. Others complained that the interest charges are not allowable, though they did not show concern at borrowing itself.

One company financial officer felt that any debt is a matter of concern. Degree of alarm expressed did not necessarily relate to the amount of debt, but the company that did take the gravest view of the situation—Douglas—is one heavily engaged in new financing.

These views are not contradictory if allowances for viewpoints are made. Borrowing itself is an accepted if unpleasant part of business life, and the figures mentioned here seem relatively small when compared with the total gross short and long term corporate debt of $276.6 billion at the end of 1957.

Traditionally the aircraft industry has had to operate with maximum flexibility: combining relatively low equities with large short term bank borrowings when big contracts became available.

The potential danger, as Douglas points out, is that the industry is being forced into a permanent change in its capital structure that will bring about drastic changes in long range.

Thus while increased borrowings in themselves might not be considered alarming, they may be regarded as a symptom of danger when placed in perspective with these factors:

• **Reductions in progress payments** for military business which have introduced an artificial and inflexible element into the industry financial picture. Hazards of the slow-paying customer are well recognized in all types of business.

• **Inventories are rising,** due in part to the reduction in payments. According to the Aircraft Industries Assn., they rose from $875 million in 1956 to $945 million last year. Though probably due in part to inflation, and general growth of the industry, this figure has been rising over the last 10 years.

• **Receivables are rising,** also a natural consequence of the payments reduction. This as well is a measure of the growth of the industry itself. AIA points to an increase from $594 million in 1956 to $792 million in 1957.

• **Fixed assets;** that is, investment in company-owned facilities, is rising. AIA quotes a 12-company total for plant investment rising from $154 million in 1952 to $431 million last year.

None of these things are so dangerous in themselves. The trouble comes when they get out of balance.

What this all adds up to, according to AIA, is the threat of overcapitalization, a major factor in many aircraft company bankruptcies after World War I.

The dangers are obvious to a heavily capitalized industry with substantial long term debt in a situation such as last summer when contracts as that for the Navaho cruise missile were canceled and many others cut back or stretched out.

Encouraging signs are present also:

• **Industry weathered** the first storm last summer. When the cutback situation looked darkest, it was feared the industry would need to borrow a billion dollars, exceeding the ability of the banking system to provide. There was talk of a government-backed V-loan type program. Actually the total came to about $300 million, one banker estimated, and the banks were able to handle industry needs for the most part.

• **Industry has met** little difficulty in borrowing money, either short or long term.

• **Increased borrowings** to some extent can be interpreted as a sign that production programs are in the works and profits should follow. However, the drop in industry profit margins below 3% leaves less and less room for financing of privately owned facilities, on which the government is insisting more and more, and to carry heavy inventories and receivables.

Most companies in the AVIATION WEEK survey responded that they would have to borrow further this year. Douglas pointed out that the reduction in cost reimbursement from 100% to 80% on cost plus fixed fee contracts will play an increasingly important role in its borrowing requirements. This is noteworthy because of the trend toward more research and development type contracts for industry with the push toward space.

All companies would prefer bank borrowing. Prime interest rates for bank loans, which were running around 4½% during the tight money period last year, have dropped to 3½%. Even though need for compensating balances, usually 10 or 20% of the amount of the loan which must be left on deposit has raised this to an effective rate of 4⅛% in individual cases, this is less than long term financing rate at 5% or 5¼%.

Some companies have reached the maximum borrowing available on lines of credit and may be forced to borrow through public offerings. Most of these long term offerings have been debentures—in effect, unsecured bonds. In some cases, these issues have been marketed successfully without being convertible. Douglas, for example, sold its latest $60 million issue without conversion rights, and though it got off sluggishly, it brought a slight premium.

Often these debentures have to be sweetened for the buyer by including the conversion rights. That is, the debentures can be exchanged for common stock at a fixed price selected before the issue is sold. If the stock price falls, the investor can keep his higher yielding debenture. Should the stock show considerable appreciation over the years, the convertible debenture owner then can make a profitable switch.

While some companies are thus forced into long term borrowing, others find it necessary to enter the long term

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A DIVISION OF NORTHROP AIRCRAFT, INC.

VAN NUYS, CALIFORNIA AND EL PASO, TEXAS

RADIOPLANE DRONES

ARMY
NAVY
AIR FORCE

WHAT IS RADIOPLANE?

Radioplane, a division of Northrop Aircraft, Inc., has been producing drones since 1938. And since 1938 Radioplane has concentrated its efforts almost entirely in the drone field, having produced and delivered tens of thousands of drones to all of the United States Armed Forces for defense training.

WHAT IS A RADIOPLANE DRONE?

A Radioplane drone is an unmanned aircraft designed to be flown by remote or self-contained control to perform a specific military mission at the lowest cost and with the highest efficiency. Every drone produced by Radioplane is developed to meet particular defense requirements which cannot be fulfilled by man-carrying aircraft.

WHY A DRONE FAMILY?

Drones are required to serve as targets for the *evaluation* of modern weapons, in the *training* of weapon crews, and for aerial *surveillance*. Each of these vital areas requires a special drone application. For this reason, Radioplane has developed this family of drones (left to right):

XQ-4A... Evolving from the supersonic XQ-4, the Air Force XQ-4A is a highly sophisticated target drone designed to cope with the exacting and comprehensive requirements of evaluating the kill-ability of modern weapon systems.

OQ-19 TYPE... Standard radio controlled aerial target for all the military services, the tough, reliable and versatile OQ-19 drone is used all over the world as an economical training target.

SD-1... Without endangering a pilot's life, the U.S. Army Signal Corps' SD-1 can be flown by remote control on photo

field because of the conditions which give rise to the need for borrowing. As Frederick E. Hines, vice president-finance for Douglas pointed out:

". . . the increased financing of government inventories and receivables appears to be permanent in nature and, therefore, not something to be financed solely through short term borrowings."

Interest costs, though deductible in part on corporate income tax, are a drag on earnings. For example, Douglas reported interest charges rose from $444,000 in 1956 to $2,329,000 in 1957. Boeing's interest charges rose from $71,000 in 1955 to $2,050,000 last year.

Whether any allowance will be made for the increased borrowing and capital investment required by change in government policy is an unsettled question. The industry has been pressing for such consideration, with little formal result. There has been some talk among bankers, however, that unwritten consideration will be given to this problem in fixing fees.

AMC Contracts

Wright-Patterson AFB, Ohio—Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command:

Fairchild Camera and Instrument Corp., Syossett, N. Y., Fairchild-Polaroid ID camera model F-301, type KS19 and ground support equipment, (PR MO-8-6780-1503), $69,732.

Propeller Division, Curtiss-Wright Corp., Caldwell, N. J., throttle control assemblies, P/N 155630 for use with C432S-C24 propeller for ZS2G-1 airship, (MIPR R57-105-30154-NOas), $27,950.

General Electric Co., West Lynn, Mass., combustion starters, type MA-10 for KC-135 aircraft, (PR PE-7-03J-4606 and amendment 1), $757,350.

Breeze Corp., Inc., Union, N. J., starter-generators, type MC-1, p/n VG-600; starter-generator cover (blast cap), model VG-544 for Q-2A aircraft, (PR PE-8-03C-3551), $118,260.

Lear, Inc., Grand Rapids, Mich., rate gyroscope transmitter, type TRU-2/A, for use on F-105 and F-106 aircraft. (PR PE-8-05C-3226 and PE-8-05C-3323), $65,108.

Projection Optics Co., Inc., Rochester, N. Y., ground photographic equipment and anamorphic lens, (MIPR R58-565-989), $332,000.

J. & H. Smith Manufacturing Co., Newburgh, N. Y., antenna, AT-256A/ARC, for B-52G, C-103B; supply; AKT-7; telemetric data transmitter; (PR PE-8-16A-2037, MD-8-16A-20628, and P/O SM-8-16A-2037), $36,953.

General Electric Co., West Lynn, Mass., product improvement of temperature system, (PR PE-8-05D-3274), $26,187.

Viewex, Inc., Long Island City, N. Y., A-9B film magazine applicable "K" series cameras for use on B-52 series aircraft; (PR PE8-10A-3600), $57,691.

Cine Products Supply Corp., Ashland, N. J., various spare parts for JAN projectors and ground support equipment, (MIPR R58-88-13245/SPCC and MIPR R58-38-158 88/SPCC), $42,620.

Bill Jack Scientific Instrument Co., Selana Beach, Calif., cable harness assemblies for use with RF-101 Aircraft, (PR MO-8-6760-1457), $31,587.

Granger Associates, Palo Alto, Calif., traveling wave amplifiers, model 107 series, (PR 813236-A), $31,177.

Pioneer-Central Division, Bendix Aviation Corp., Davenport, Iowa, altimeter pressure, 1¼", dial, integrally lighted, type AAU-2A, for use in F-105 and F-106 aircraft. (PR PE-8-05C-3266 and PE-8-05C-3266-1), $37,313.

A & Z Engineering Co., Covington, Ky., film plotting table, type A-6 and ground equipment, (PR MO-7-10B-730 and MO-8-6740-1338), $46,896.

Charles Bescler Co., East Orange, N. J., overhead projector, type I, size C and ground support equipment, (MIPR R58-88-08468/SPCC and amendments 1 and 2), $69,782.

Pioneer-Central Division, Bendix Aviation Corp., Davenport, Iowa, indicator, indicated, airspeed, 1¼" dial, integrally lighted, type AVU-2/A, for use on F-105 and F-106 aircraft, (PR PE-8-05C-3267, PE-8-05C-3267- and PE-8-05C-3531), $77,825.

John Oster Manufacturing Co., Racine, Wisc., indicator, thrust, AEU-2/A, for F-106A, F-106B, F-105D, F-105E, F-105A and T-105B aircraft, (PR PE-8-05D-3329, -1 and -2), $94,055.

Lockheed Aircraft Corp., Burbank, Calif., engine flight test on F-104 airplane, (PR PH-8-1510-7132), $837,394.

Lockheed Aircraft Corp., Burbank, Calif., flight test of in-flight refueling on F-104 airplane, (PR XI-8-1510-7193), $151,072.

North American Aviation, Inc., Los Angeles, Calif., parts, components, and assemblies for the manufacturer of F-86F airplanes in Japan (MAP), (PR PH-7-10A-7394), $151,731.

Kearfott Co., Inc., Clifton, N. J., controls, vertical, component of the AN/AJN-3 compass system in support of the F-101B aircraft, (PR PE-8-05A-3394), $26,070.

Propeller Division, Curtiss-Wright Corp., Caldwell, N. J., P/N 160344 blade fairing heating element assembly with design 1060-25C5-12 blades for the C-133 aircraft, (PR PE-8-03A-3305), $2,927,577.

Bell Helicopter Corp., Ft. Worth, Tex., rotor de-icing for H-40 helicopter, (PR 7499), $150,000.

Sundstrand Machine Tool Co. Division, Sundstrand Aviation, Rockford, Ill., drives, generator, constant speed, hydraulic, consisting of mission and gear box assemblies, shafts, covers, spare parts and data; frequency and lead controllers, a component of alternator drive, constant speed for F-106 aircraft, (PR PE-8-031-3389 and PE-8-03C-3388), $1,256,476.

Aircraft Radio Corp., Boonton, N. J., radio receiver, ARC type R-19-28V, radio receiver, ARC type R-20A-28V and transmitter-converter TV-10/ARC-12 for T-37A aircraft, (PR PE-8-16A-3384), $191,447.

Lear, Inc., Grand Rapids, Mich., control assembly, attitude, gyroscopic, type AF/A24G-1 for use on F-106 aircraft, (PR PE-8-05C-3530), $771,047.

Rosemont Engineering Co., Minneapolis, Minn., probe, temperature, type MA-1 for F-101B, F-105B, F-105C, F-106A and B-58A aircraft, (PR PE-8-05C-3458), $27,216.

Barber Coleman, Rockford, Ill., actuator, and box, (PR SA-8-03CI-4677), $118,120.

B. F. Goodrich Aviation Products Division, B. F. Goodrich Co., Dayton, Ohio, spare nose wheel assemblies for C-131B, C, D, E aircraft, (PR 00-8-03B-1105), $29,-078.

Scranton Corp. Division, Eicer, Inc., Chicago., Ill., alternator assembly, engine driven 8 kva., 115 v. single phase, variable frequency, type B-1 to support C-97A, C, D, C-124A, T-29A, B and KB-50 aircraft, (PR SA-8-03C1-4675), $218,700.

U. S. Gauge Division, American Machines and Metals, Inc., Sellersville, Pa., gage, pressure dial indicating, hydraulic, type ME-1 for F-104C, F-105B, KC-135A, and T-37A aircraft, (PR PE-8-05D-3563), $48,-847.

General Electric Co., West Lynn, Mass., indicator, electrical tachometer, type ERU-2/A for T-33A aircraft, (PR PE-8-05D-3500), $31,925.

Lear, Inc., Grand Rapids, Mich., actuators and adapters for F-86D and C-131B aircraft, (PR SA-8-03C1-4663), $51,579.

General Electric Co., Waynesboro, Va., panel-controls, automatic and data for B-66B, RB-66B/C, WB-66D and C-133A aircraft, (PR SA-8-03C-4733), $37,995.

J. B. Saltzman, Inc., N. Y., N. Y., vertical reflecting projector, type AP-2, spare parts, data and ground support equipment, (PR MO-8-6730-1215), $75,600.

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G.E.'s versatile, Type H halogen leak detectors locate leaks quickly and accurately in any system or component under pressure or vacuum. They are easier to use and much more sensitive than ordinary methods of leak detection.

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FAFNIR breaks the "bearing barrier!"

Breaking the sound barrier is duck soup for planes equipped with the mighty Pratt and Whitney Aircraft J75, our most powerful production turbojet.

A far tougher "barrier" was the problem of meeting main rotor bearing specifications. Conventional bearing construction couldn't take the loadings and temperatures encountered in such an application. Pratt and Whitney Aircraft looked to Fafnir for help.

Result: custom-designed and custom-built bearings tailor-made for the J75 main rotor mounting. Fabricated of vacuum-melted steel, these bearings feature intricate, split inner ring construction. Tolerances are held to millionths-of-an-inch.

This masterpiece of bearing engineering is another example of how Fafnir research and production facilities are geared to the increasingly complex needs of the aircraft engine and airframe industries. Worth bearing in mind when *you* hit a "bearing barrier!" The Fafnir Bearing Company, New Britain, Conn.

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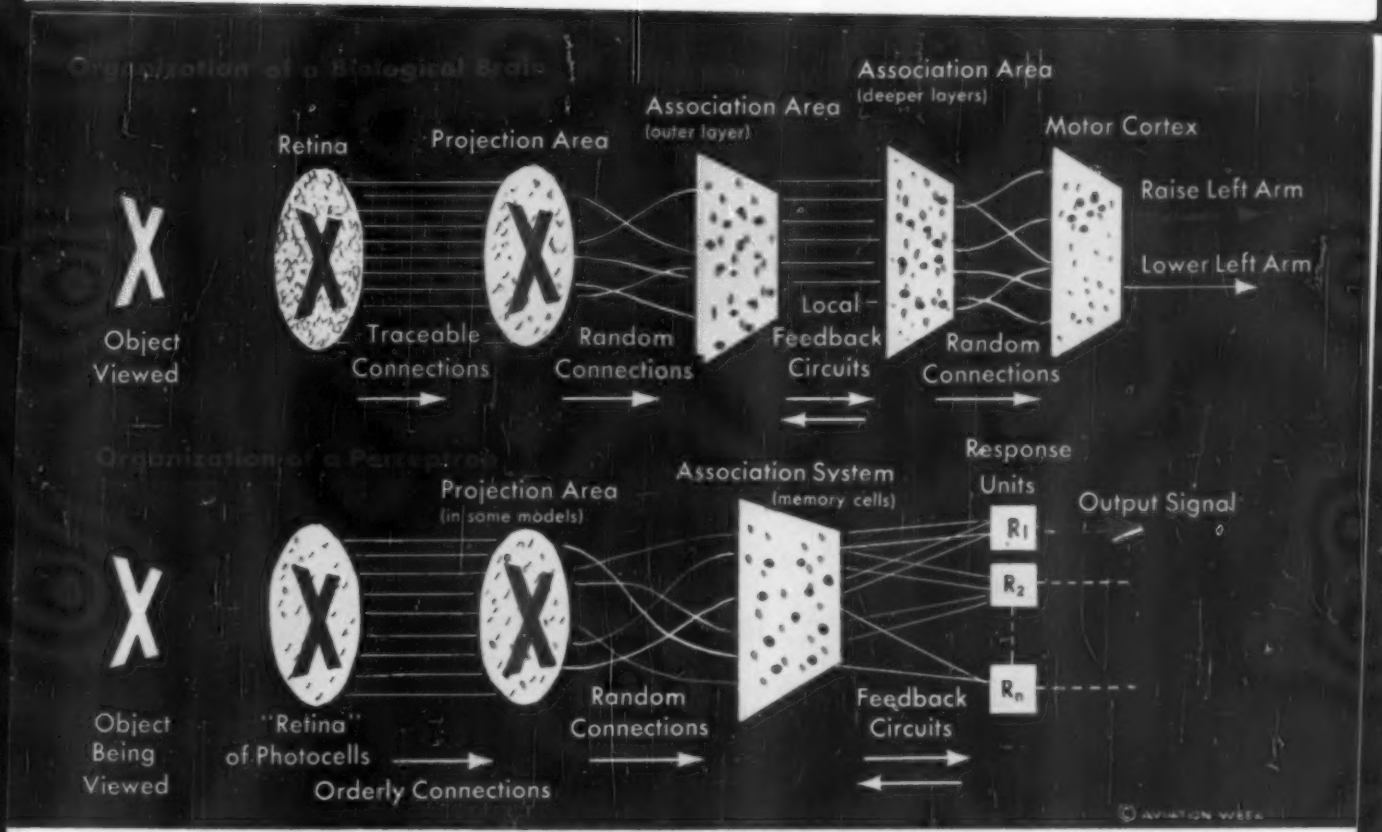
Fafnir J75 Main Rotor Bearing, one of 23 Fafnir bearings used in P&WA jets and accessories. Each of these super-precision bearings is exhaustively factory-inspected on special equipment —including many highly refined devices developed by Fafnir for this purpose.

The Pratt and Whitney Aircraft J75 turbojet, Fafnir-equipped, packs 20,000 pounds of thrust.



COMPARISON between the generally accepted organization of the mammalian brain and the Perceptron is shown above. Source of the sensory inputs in the illustration is limited to the eye. Connections between the retina and the visual projection area of the brain are organized and may be traced. Beyond this point they become increasingly disorganized. The association cells of the brain in this random hookup are likely to respond to widely varying stimuli from more than one sensory system, indicating that they contribute to many separate memories of learning processes. Motor cortex or response system is again systematically organized. Perceptron which greatly resembles this biological system is based on the laws of probability as applied by Cornell Laboratory's Rosenblatt.

Human Brain

predicted situations and many others.

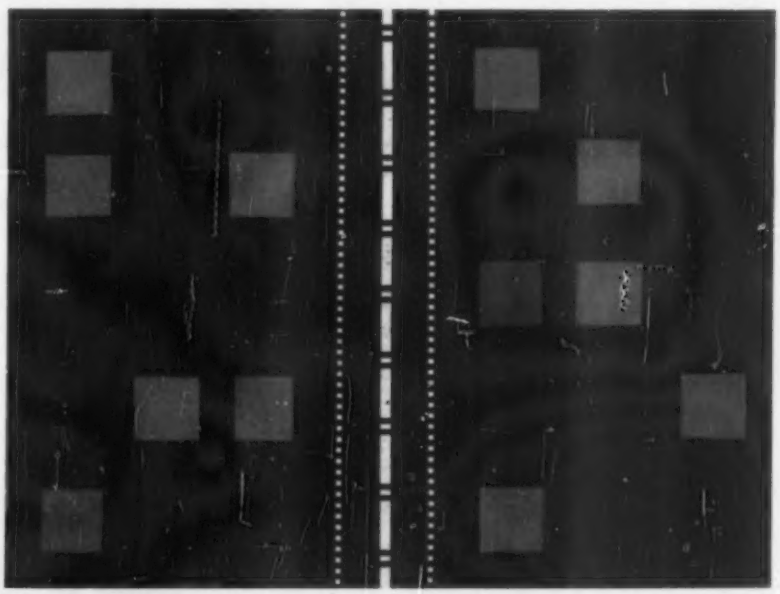
Rosenblatt and Yovits indicate that the major problem now is to develop small, inexpensive and reliable integrators to serve as the memory cells of the Perceptron.

Currently available equipment which could serve as integrators cost in the neighborhood of $100 per unit and, compared with some of the proposed units which are considered to be practical now, are comparatively large and heavy.

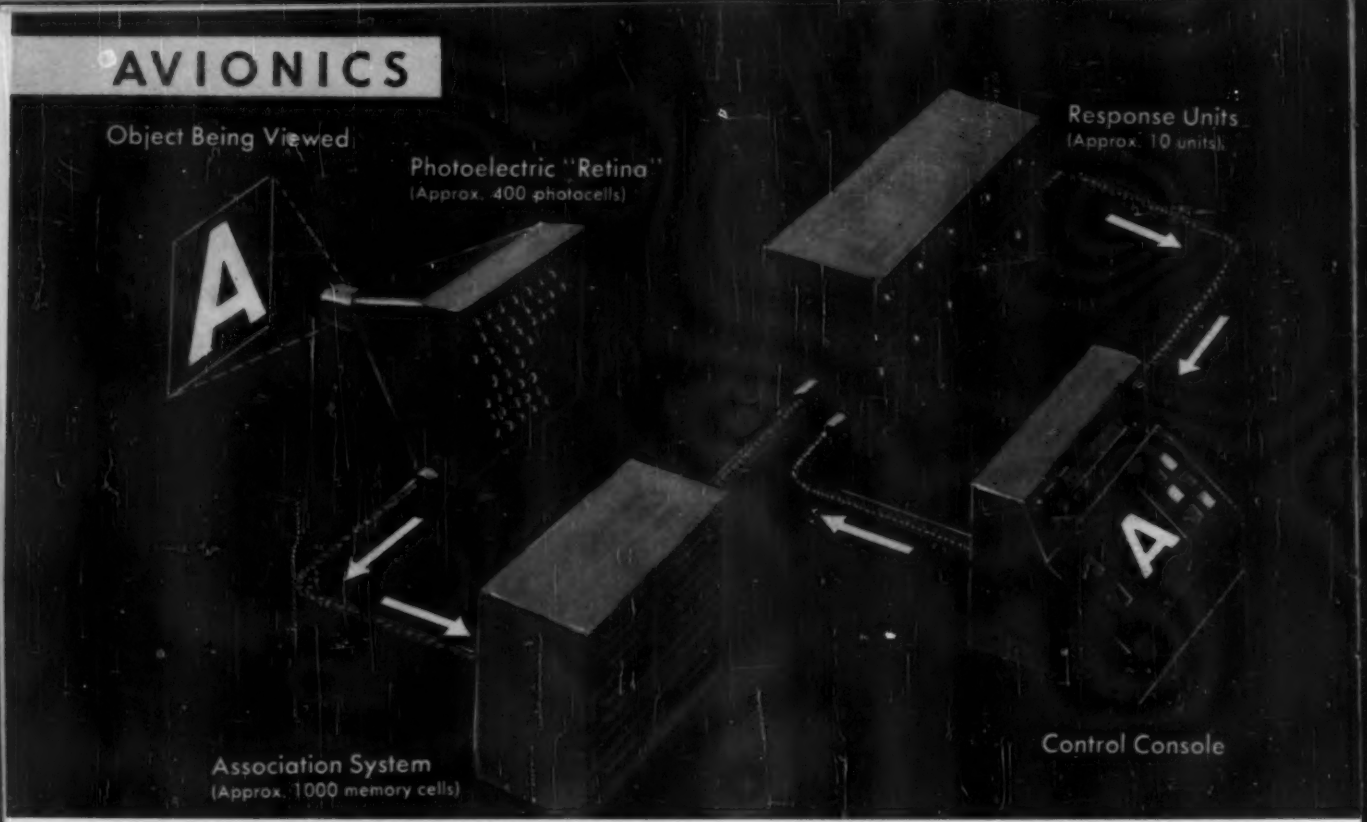
Size and Cost

It is hoped that the 100,000 memory cell Perceptron would not be larger than a normal size desktop and would not cost more than $1 million per machine.

The memory cells in the pilot model of the Perceptron will probably be large electro-mechanical units which are complicated and relatively expensive, but can be counted on for reliable performance. It has been estimated that the construction of the pilot model and



FIRST experiment in which an unaided machine classified information was performed at Cornell Aeronautical Laboratory less than one month ago. A digital computer was programmed to function as a slow-motion Perceptron with two responses. With no prior information this machine was exposed to an environment of squares as shown above. The squares were shown singly (dark squares). After seeing about 50 squares in various positions (light square) the machine had adjusted its two responses to give one for the left-hand squares and the other for the right-hand squares.



PILOT model of a Perceptron to be built during the coming fiscal year at the Cornell Aeronautical Laboratory will resemble this sketch. Machine will employ "eye" of photocells. Other sensory systems could be used, E. G. audio, radio, radar, sensory systems. Signals would enter the association or memory cells which would in turn invoke a response from the machine. On the pilot model response will probably be made by lights or printing code letters. An audio-Perceptron could learn to speak and answer verbally. Actual number of memory cells and response units has not been definitely set. Console is for human operator during "teaching" sessions. It is believed that full-scale Perceptron could eventually be made the size of normal desktop.

Electronic Device Simulates Processes of

By J. S. Butz, Jr.

Washington—New statistical theory which is the basis of an electronic device that simulates the thinking processes of the human brain and may explain the mechanism of human memory has been developed by Dr. Frank Rosenblatt of the Cornell Aeronautical Laboratory under the auspices of the Office of Naval Research.

The new theory has been proven experimentally through a slow motion model of a machine called a Perceptron which has actually demonstrated its ability to teach itself.

Less than one month ago, the simplest type of a Perceptron model, which could make only two responses, was placed in an environment that consisted simply of squares. Without human aid it perceived that some of the squares were located on the right hand side of its "field of vision" and some were on the left. After seeing about 50 squares randomly located at various vertical positions on both sides of the "field," the machine adjusted its two responses so that one was always given when a square was situated on the left side of the "field" and the other when the square was to the right.

This was the first time that a completely unprogrammed, unbiased electro-mechanical system had organized any information into a concept. Later experiments have shown the machine to be capable of teaching itself the difference between several letters of the alphabet.

IBM 704 Used

The work so far has been conducted on an IBM 704 computer especially programmed to simulate the Perceptron's unique wiring. This has resulted in a slow motion model of the Perceptron that takes about 30 min. to accomplish what an actual Perceptron could do in a few thousandths of a second.

This work has been under ONR sponsorship for about one year. Dr. Marshall Yovits, the ONR project officer, indicates that $40,000 will have been spent at the end of this fiscal year. The Navy hopes to provide about $100,000 during the coming fiscal year for the construction of a pilot model of the Perceptron with possibly 1,000 memory units. It is believed that this machine will further prove Rosenblatt's memory theory which indicates that a larger Perceptron with about 100,000 memory units should be capable of working in very sophisticated fields either through its own learning process or the teaching efforts of a human operator.

These fields include: language translation; library research on a much more detailed and complete scale than now possible; virtually complete patent review in contrast to the rather sketchy review feasible today; guidance systems for attack vehicles that could contribute to the decision-making responsibility now completely on the shoulders of the human crew; reconnaissance systems that would be able to report concepts as well as uncorrelated data about un-

obtaining the first significant data from its operation will probably require a year with the present effort.

A description of the Perceptron which will appear in an Office of Naval Research publication "Research Reviews" in the near future reads approximately as follows:

The Preceptron is the first nonbiological system known to be capable of classifying, conceptualizing and symbolizing its environment—especially a completely new and unanticipated environment—in the absence of human training and control. The Preceptron can be expected to learn spontaneously without assistance of training from a human operator.

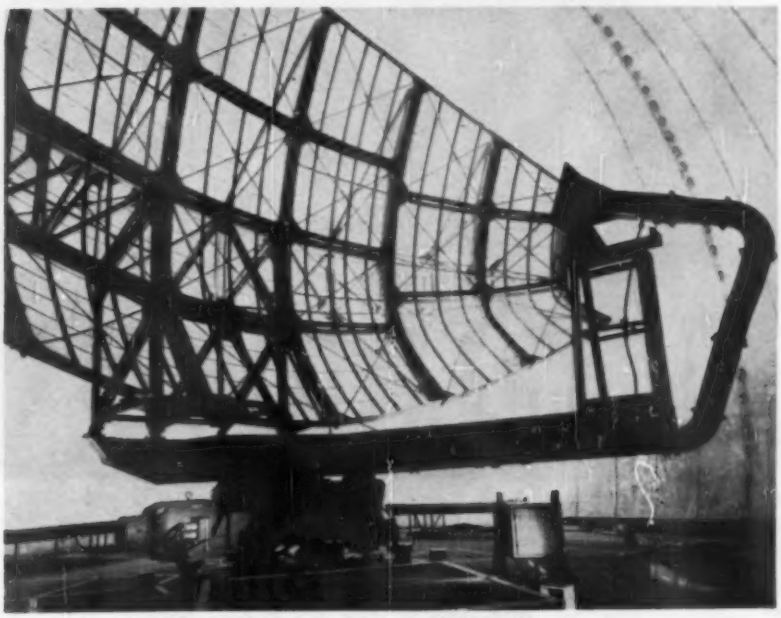
In comparison the most modern digital computers, sometimes erroneously called "brains," could be described as very rapid adding machines which stop or balk when any original decision is required.

They are dependent on man to set up or program the method of solving all problems.

The Perceptron can receive its data through audio, visual and the other types of sensory systems which supply information to the human brain. Radar and other electromagnetic devices could also be used as sensors. Artificial sensory units would provide the Perceptron with a much wider "range" of experience than any natural system, but generally they could not match human sensitivity and resolution in certain areas.

The "central nervous system" of the Perceptron, which takes this sensory information and identifies it, classifies it and uses it to form concepts, is believed by Rosenblatt and naval scientists to approximate the human process more closely than any other machine. The memory cells of this associate system or brain of the Perceptron are for the most part wired together randomly and not connected in a precise pattern as in an ordinary electronic computer. Most of the cells are excited together when information is received by the Perceptron rather than using a separate memory cell to store each bit of information.

This agrees with generally accepted physiological findings which indicate that the nerve fibers connecting living sensory and motor systems are organized and traceable except through the association or "thinking" cells which are apparently connected randomly. As a consequence the removal of certain portions of the brain cuts through part of this orderly network of direct connections and can impair the sensory and motor functions. On the other hand the memory appears to be distributed throughout the association



Radar Coordinates Missile Firing

Primary radar for Army's Missile Master System is General Electric Co.'s AN/FPS-33, used in conjunction with the AN/FPS-6 height finder. Missile Master is designed to coordinate fire of Nike and Hawk missiles in air defense of the U.S. First operational AN/FPS-33 has been installed at Fort Meade, Md., initial Missile Master installation. New radar combines two improved AN/FPS-8 radars with a newly designed common antenna to increase range coverage by 52% and to extend elevation coverage, according to the company. As presently designed, identification of a Missile Master radar target as friend or foe must be obtained from the local SAGE Direction Center.

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That the weakest place must stand the strain;
And the way to build it is only jest
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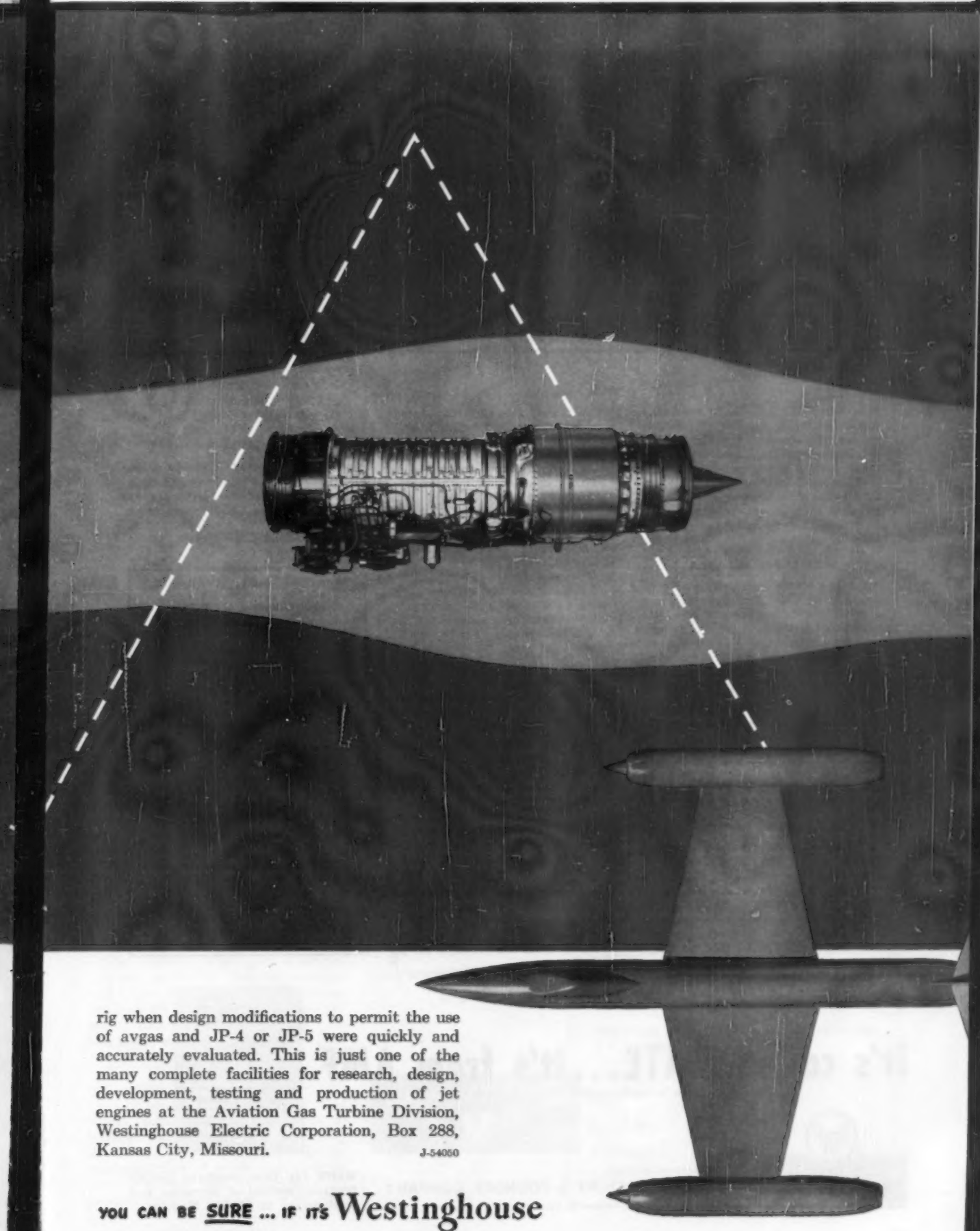

rig when design modifications to permit the use of avgas and JP-4 or JP-5 were quickly and accurately evaluated. This is just one of the many complete facilities for research, design, development, testing and production of jet engines at the Aviation Gas Turbine Division, Westinghouse Electric Corporation, Box 288, Kansas City, Missouri. J-54050

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Development of the latest J34 configuration for use in North American Aviation's T2J trainer proved the value of this water flow analogy test

cells and partial removal of this tissue has little effect on the memory.

Rosenblatt's theory of human perception rests on two general assumptions. The first is the concept of the "distributed" memory just described and the other is the psychological premise that any intelligent organism must obtain an understanding of its environment through learning and experience rather than through inheritance.

In keeping with these assumptions the memory cells of the Perceptron are all of equal strength and completely unbiased and unprogrammed before the learning process begins. The connections between the memory cells are randomly distributed only in the sense that most of them do not follow a rigidly required pattern. This does not imply that the connections change while the machine is in operation.

How Perceptron Learns

The Perceptron learns and classifies information in a fairly easy to understand manner. Using the visual or photo Perceptron as an example, the machine sees its environment through a lens which focuses an image and a "retina" of photoelectric cells. Each image or stimulus activates a portion of the photocells. The signal from the activated photocells passes randomly through a portion of the memory cells as it reaches the response units, one or more of which would be turned. The memory cells which conducted this signal to the "on" responses are strengthened and their future output signals tend to dominate the output of the other memory cells. An aftereffect or memory trace is created by the relative dominance of these memory cells.

During the early part of any learning program the machine, like a human, tends to make mistakes. However, under repeated exposures to the environment some traces are gradually reinforced, and it can be shown by probability theory that certain stimuli nearly always will invoke the same response. The machine is then said to have reached and evolved certain "concepts" about its environment.

The number of concepts developed and the probability that the machine will adhere to them and give the proper response for a given stimulus are primarily functions of the memory cells and response units in the machine and the complexity of the environment.

It is possible that the Perceptron will not spontaneously reach the conclusions about its environment that would be of the greatest assistance to humans who were using it to classify data, etc. The classifications that the machine arrive at might not coincide with those that had been used in organizing large existing files and libraries,

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AMF has already designed and produced 19 of these modules—each one a self-sufficient package with a distinct responsibility. Available to you on an "off-the-shelf" basis *now*, are programming and control modules, signal translator modules, comparator-evaluator modules and display devices.*

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These modules can be put together to implement *any* automatic testing program. Or, any of them can be integrated with existing equipment of other manufacture.

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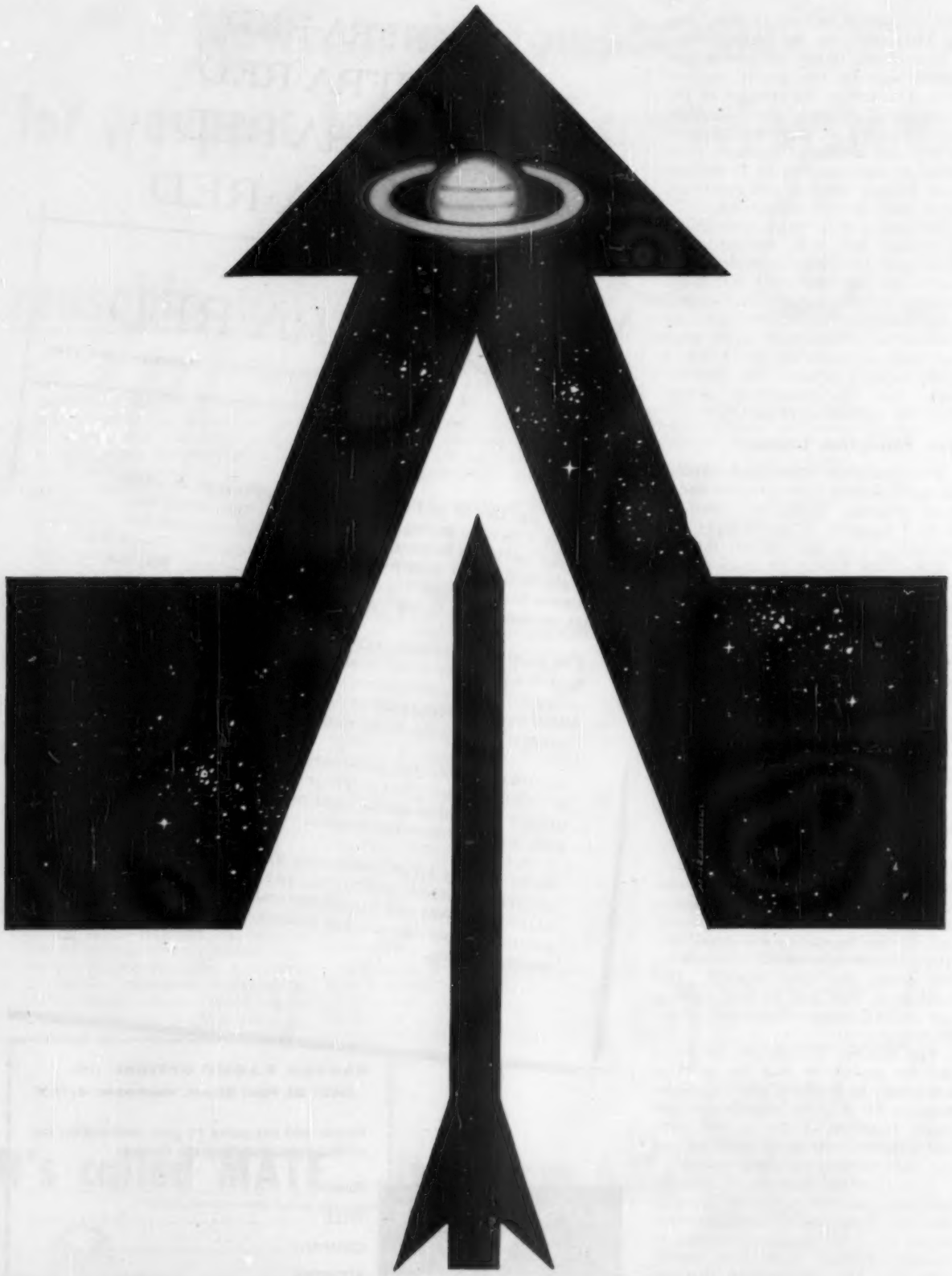
WRITE for this brochure listing features, method of operation and applications of MATE Modules.



"...your old men shall dream dreams, your young men shall see visions."

JOEL 11:28

This is the Missile Age. But where will it lead? What are its visions?

At Martin, advanced design engineering and pure science are independently at work seeking answers to these space-sized questions.

Advanced Design: Top systems designers, requirements specialists and creative engineers—on such pioneering projects as VANGUARD, TITAN and a variety of related space systems developments—are already applying their cumulative knowledge to tomorrow's technical problems of lunar probe and manned orbit vehicle design.

Pure Science: And at our Research Institute of Advanced Study an already established and recognized organization of independent scientists is at work in the field of fundamental research, which alone can open the closed doors of tomorrow's technology. Work currently under way at RIAS includes new investigations into particle physics, gravitation, photosynthesis and cosmic radiation.

Somewhere in the early hours of tomorrow, these two main bodies of creative effort will meet on the threshold of a new age beyond the missile.

MARTIN

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or in establishing arbitrary starting points in theoretical studies.

In cases of this type it is possible for the human operator to force the machine to reach the required conclusions or in effect to teach it. In an elementary example, a simple Perceptron with four response units should be able to distinguish between four different geometric figures or letters of the alphabet or any gross shapes. If only two figures were used, the machine might form concepts about the location as well as the shape of the figures in its "field of vision," rather than about the shape alone. It is possible for an operator to create and reinforce the proper memory traces in the machine so that it will form the desired concepts. This is done through the feedback signals from the response units to the memory cells which are responsible for creating the memory traces when the machine is learning by itself. Each time that a response unit is activated it sends a signal back through the memory cells that had called for its activation.

This feedback signal is the mechanism used to increase the strength of the memory cells and builds the memory traces. Psychologically, back signal "rewards" the pattern of memory cells that favored the response unit.

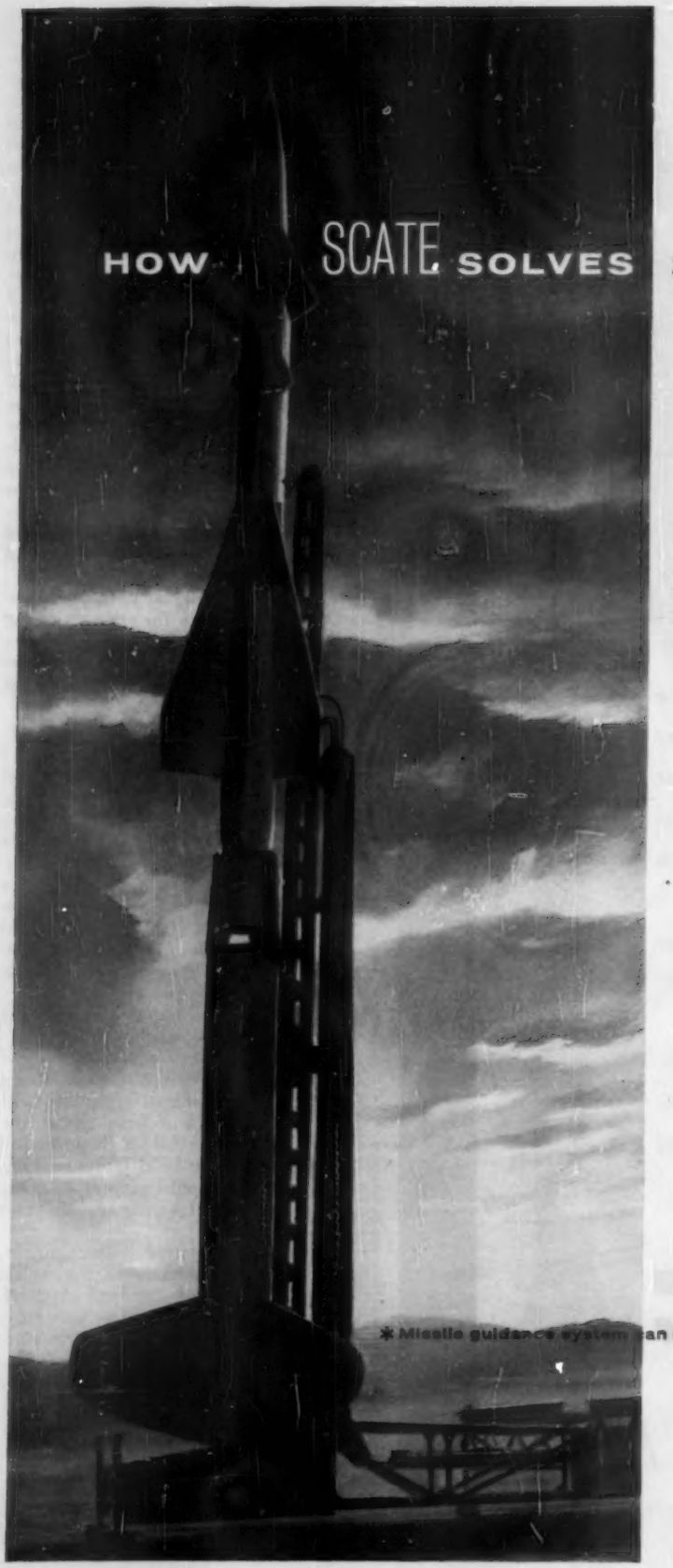
Creating Desired Concepts

A manual switch enables the human operator to create the desired concepts within the machine. Loosely termed a "reward" button, this switch allows any trace in the memory cells to be reinforced or "rewarded' when a given stimulus receives the proper response from the Perceptron. If an undesired answer is given the operator may "punish" the memory cells which caused the response and lower their strength.

Rosenblatt's memory theory and the Perceptron are based on the mathematics of probability which do not require a complete description or wiring diagram of the internal organization of any system. Such a basis allows the probable reaction of a hypothetical nervous system to be determined from a given set of inputs without knowing the exact internal wiring of the brain or memory cells.

This mathematical development, which Cornell Laboratory's Rosenblatt terms the theory of statistical separability, differs from most of those previously used in the study of mechanical computers and the human brain. These studies have primarily depended on the use of symbolic logic and Boolian algebra and require precise knowledge of the wiring and switching arrangements in the complete system before responses can be determined. Digital computers are designed using these methods.

While Rosenblatt's theory gives the



2 BASIC PROBLEMS in testing electronic systems

Many complex electronic systems—missile guidance is a good example—may require testing that takes days by conventional methods. Yet the end function of such a system may last only a few minutes—**even seconds.**

Other systems, though less complex, must be tested in such large numbers that adequate personnel are frequently unavailable to perform tests by conventional means.

The SCATE system of automatic test equipment can solve **both** problems. It provides **self-checking** automatic testing which is **fast, flexible** and **foolproof.**

The system evaluates all important parameters of equipment under test, including:

1. RF sensitivity, center frequency, band width, power output, noise figure.
2. Audio frequency gain, band width, power output.
3. Video pulse circuitry, including pulse decoding, logic, digital comparison, pulse delays.
4. Voltage levels, DC and AC.
5. Servo response.
6. Mechanical response.

Stromberg-Carlson has standing designs for all the standard components which go into a SCATE system, and is fully experienced in designing custom components which may be required in any test system.

Complete details on the SCATE system and other Stromberg-Carlson automatic test equipment are available on request.

* Missile guidance system can be tested automatically by the SCATE system.

"There is nothing finer than a Stromberg-Carlson"

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A DIVISION OF GENERAL DYNAMICS CORPORATION
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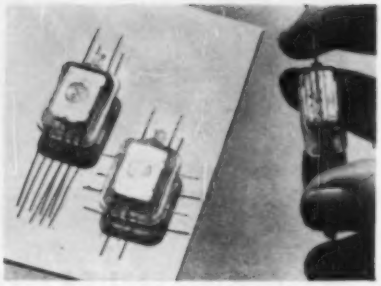
Electronic and communication products for home, industry and defense



"Match-box" Tubes

Novel rectangular envelope shape for receiving tubes, which provides greater reliability, shock-resistance and improved performance, yet permits use of same electrode structure as conventional tubes, has been developed by Westinghouse Electric's electronic tube division, Elmira, N. Y. New "match-box" design eliminates cantilever construction, reducing microphonism. It also permits more compact chassis layout, provides greater spacing between leads for lower inter-electrode capacitance.

Perceptron more human-like qualities than the digital computer, the digital machine has the same advantages over the Perceptron that it does over man. The digital computer is specifically designed to perform rudimentary mathematical processes very rapidly and very accurately so that it can solve complicated equations in minutes where man would require years.

Teaching the Perceptron basic mathematics would be as laborious as teaching the human and it would probably have about the same tendency toward inaccuracy as man.

Perceptron's Promise

Great strides are being made with digital computers but as far as memory storage for a given size, speed of operation and the ability actually to duplicate the human process of classifying information without direction, no digital proposal has approached the Perceptron in promise.

Rosenblatt believes that the most capable computers of the future probably will combine features of both the Perceptron and the digital machines. He also believes that they will be designed only after investigators in the field have devoted more time to interdisciplinary study in contrast to the tendency toward narrow specialization that exists in many quarters today. Rosenblatt's Ph.D. is in psychology but he has devoted some years to statistical mathematics and electronics which has reinforced his belief that ideas of great importance will result from more cross-fertilization between the fields. As Rosenblatt is 29 years old, he should have considerable time to see if his point will be proven.

PIONEERING IS OUR BUSINESS

CRYOGENIC SYSTEMS

Pioneer in the field of air-borne cryogenic systems, Pioneer-Central offers a complete line of liquid gas converters, valving, and capacitance gaging for artificial atmosphere equipment and compartment cooling and pressurization.

ALTITUDE SURVIVAL SYSTEMS

Finest in breathing regulators—from mask mounted through pressure suit and capsule controllers, global survival kits and emergency equipment to support man in the high performance air vehicle.

FUEL FLOW SYSTEMS

Pioneer vane type fuel flow systems, long the standard of the industry, have now been augmented by new, true mass flow systems of unexcelled accuracy and flexibility as required for jet aircraft and missile applications.

FLIGHT INSTRUMENTS

Pioneer accuracy and dependability are exemplified in the complete line of Airspeed, Mach-Airspeed, Vertical Velocity and Turn and Slip Indicators, Accelerometers as well as Altimeters, both compensated and stand-by.

MISSILE COMPONENTS

Pioneer-Central's cryogenic and instrument design and production experience is now being utilized in the production of cryogenic valves, pressure sensing probes and liquid level sensors for advanced missile systems.

ULTRASONIC CLEANING SYSTEMS

Pioneer in the application of ultrasonics to the volume cleaning of parts and assemblies, Pioneer-Central is the first to offer a fully integrated, cabinetized type of ultrasonic cleaning system.

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Pioneer-Central Division
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Bendix
AVIATION CORPORATION

Expansions, Changes In Avionics Industry

Litton Industries has purchased Airtron, Inc., Linden, N. J., maker of microwave components, another in Litton's growing list of acquisitions. Airtron, whose current annual sales rate is approximately $10 million, employs 800 persons. David Ingalls continues as head of Airtron and will become vice president of Litton.

Other recently announced expansions and changes in the avionics field include:

• **DI-AN Controls, Inc.,** will be new name of Mack Trucks Inc. electronics division, following Mack's decision to get out of the electronics business. Mack will complete present commitments but is not accepting new business.

• **Stanford Research Institute** has formed new Radar Aerophysics group to carry out studies involving organization and operation of proposed Air Force Air Weather Service nation-wide radar storm detection network. Long-range plans include research on application of computers to weather analysis and forecasting. Dr. Myron G. H. Ligda heads new SRI group.

• **Kaiser Aircraft & Electronics,** division of Kaiser Industries Corp., has formed new engineering research and development department which will be located at company's Richmond Machining plant in California. Wallace C. Grove will head new group in addition to being responsible for Richmond plant operation.

• **Sun Electric Corp.,** Chicago, has acquired manufacturing facilities and product line of **Texas Instruments'** panel instrument department, which will be integrated into Sun's own instrument division. Texas Instruments is withdrawing from panel instrument field.

• **Electronics Corp. of America,** Cambridge, Mass., has established 21,000 sq. ft. manufacturing facility in Puerto Rico, near San Juan, which will produce electronic controls.

• **Offner Electronics Inc.** has broken ground for new 26,000 sq. ft. plant in Schiller Park, Ill., which is expected to employ 150 persons.

• **Longren Aircraft Co., Inc.,** Torrance, Calif., has acquired electronic assets of **Stone & Smith Co.** New acquisition, which produces missile support equipment, will be headed by John Doering.

• **Standard Electromagnetics, Inc.,** Frederick, Md., producer of relays and other electromagnetic devices, has acquired new 20,000 sq. ft. plant at Walkersville, Md.

• **Massa Laboratories,** Boston, has become division of **Cohu Electronics, Inc.,** San Diego. Frank Massa remains head of new acquisition and becomes vice president of Cohu. Massa produces ultrasonic devices and instrumentation.

• **Narda Ultrasonics Corp.,** Mineola, N. Y., has acquired **Alcar Instruments Inc.,** Little Ferry, N. J., also producer of ultrasonics. New acquisition will continue in present location, with Benson Carling continuing as president of new Narda subsidiary.

• **Grinnell-Harris Electronics, Inc.,** Rosemead, Calif., is name of new firm which will design and manufacture custom filters, magnetic amplifiers, delay lines and related devices. Morgan Harris is president; Arthur Grinnell is vice president. Company address: 4130 Temple City Blvd.

Toroidal Coil System

Microminiature torodial coils, which previously had to be wound by hand, can now be produced using new coil winding machine developed by Stanford Research Institute. Typical toroid is shown on a dime (below) to dramatically demonstrate its size.

KEY ENGINEERING OPENINGS AT VOUGHT

ELECTRONICS

Projects involve advanced guidance and control and fire control systems for missiles and high-performance manned aircraft. They begin with investigations and theory and progress through systemization and packaging to detailed hardware design. Key responsibilities await additional men who are qualified in these areas. Advanced degrees preferred.

Stability and Control Engineer. E.E., M.E., or A.E., with emphasis on flight stability and control problems or dynamics. (Special consideration given graduate study or extensive experience in transients or closed loop stability analysis.) To assist in design of autopilot and control systems for high-performance missiles and aircraft.

Antenna Design Engineer. E.E., or Physics Degree with demonstrated aptitude for antenna design. To join active projects involving design of flush-mounted, recessed and external antennas at all frequencies for very high-performance aircraft and missiles.

Fire Control and Microwave Systems Engineer. Requires E.E., or Physics Degree; at least 2 years experience in radar, data link, or fire control systems; and strong ability in this work.

Test Equipment Engineer. Requires E.E., or Physics Degree and at least 2 years experience in this or related field. (Desirable: broad background in electronics design with emphasis on digital computers or microwave systems.) To join in the design of complete checkout systems for missiles and associated subsystems.

Reliability Analyst. Requires M.E., Physics, E.E., or Math Degree; broad knowledge of electronic and mechanical systems; experience in operations research or reliability. Helpful: statistical methods experience.

To arrange for a personal interview, or for a prompt report on these or other current openings, return coupon to:

C. A. Besio
Supervisor, Engineering Personnel
CHANCE VOUGHT AIRCRAFT,
Dallas, Texas Dept. M-11

I am a _____ Engineer,
interested in the opening for _____.
Name _____
Address _____
City _____ State _____

Vought Vocabulary

in′ge·nu′i·ty: *designing a 12-ton missile to fit inside an atomic sub*

Chance Vought's *Regulus II* missile is twice as long as a city bus. It is crammed with delicate instruments, armed with a nuclear warhead. Yet Vought engineers designed *Regulus II* to serve safely, efficiently aboard the Navy's newest nuclear-driven submarines.

They shock-proofed the missile against underwater blasts. They conditioned it for polar ice, or equatorial heat. They made it – like Vought's smaller Fleet veteran, *Regulus I* – a dependable weapon, accurate from conventional or nuclear subs, from surface ships or highly maneuverable, mobile shore launchers.

Aboard its special, globe-girdling sub, *Regulus II* will move *invisibly* any distance to its launching point. There it can begin a supersonic, long-range strike in minutes. Or it may lurk unseen for months as a patient and ready deterrent.

A chilling prospect for would-be aggressors, this example of Vought ingenuity.

Scientists and engineers: pioneer with Vought in new missile, manned aircraft, and electronics programs. For details on select openings write to: C. A. Besio, Supervisor, Engineering Personnel, Dept. M-11.

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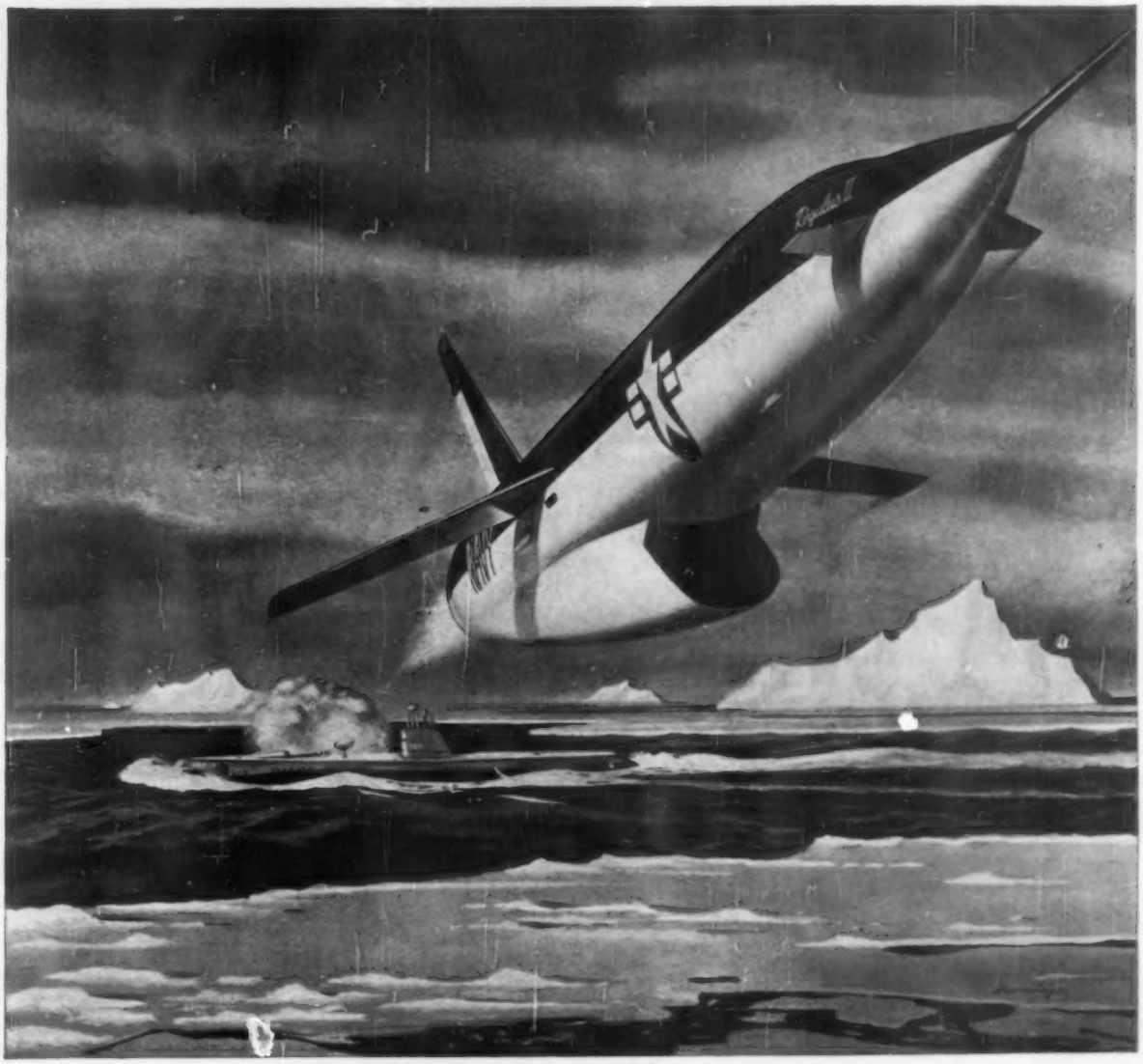

NAA is at work in the fields of the future

THE DAY AN AMERICAN RETURNS FROM OUTER SPACE...

...will be another V-day for the free world —greater, perhaps, than any it has yet known.

In the inner offices of the Pentagon... in secret areas of our defense industries... no effort is being spared to speed the day.

For it will be a human pilot—in command of a craft that will bring both him and his secrets safely home—that will truly conquer Outer Space.

The first American craft to attempt this conquest is now in its final construction stage. It's the X-15... missile-shaped and rocket-powered... product of a scientific project sponsored by the National Advisory Committee for Aeronautics, the Air Force, and the Navy. It will discover what man encounters when he enters space—and when he returns to the earth's atmosphere.

America is closing the gap

The Army's Explorers give us dramatic

proof that America had not been lagging in the race to space. The rocket engines that put the Explorers into Outer Space were minor modifications of the same engine NAA's Rocketdyne Division has been delivering to the Army since 1952. Four of America's major missiles use engines built by Rocketdyne: the Air Force Atlas and Thor, the Army Jupiter and Redstone.

Missiles of all types use principles discovered by Missile Development Division in its 12-year research program. This division is now at work on the GAM-77, advanced air-to-ground missile for the Air Force B-52.

Both missiles and aircraft depend on automatic control systems—the electronic eyes and ears of the Space Age. Autonetics Division is producing these vital systems in quantity—with complete reliability.

Back from beyond, the pilots of NAA's X-15 rocket plane will report on the new problems they discover in Outer Space.

Outward bound, USAF's Thor vaults into space on the mighty thrust of a rocket engine built by the Rocketdyne Division.

The new weapon-system concept

America now shapes its defense around complete weapon systems, each designed for a specific role. Some will be guided to target by electronics; others will have a human pilot's ability to change plans or report results. NAA builds both—and both are needed for complete security.

Los Angeles Division is building two advanced manned weapon systems for tomorrow's Air Force: the B-70, which will have global range and fly more than 2,000 mph; and the F-108, which will intercept would-be invaders far from our shores—and give us the reach to quash little wars before they become big.

Toward a brighter tomorrow

Many of North American's people are working on projects that promise a more abundant life for a world at peace. The Atomics International Division, for example, is developing practical methods for turning atomic energy into low-cost electricity. Two major power reactors are already in operation; a third is on the way for fifteen Southwest utility companies.

Today, in North American and its divisions, you'll find as potent a combination of scientists, engineers, and production men as any in American industry. Because they are constantly forging ahead into vital new technologies, much of their work holds immense promise for science and industry.

NORTH AMERICAN AVIATION, INC.

SERVING THE NATION'S INTEREST FIRST—THROUGH THESE DIVISIONS

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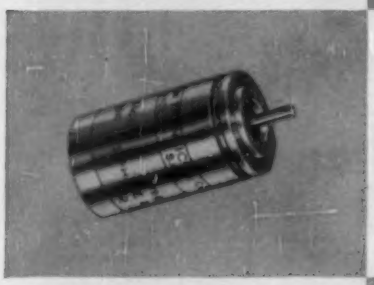
Los Angeles, Canoga Park, Downey, California; Columbus, Ohio; Neosho, Missouri

NEW

NEW TYPE 6 SERVO MOTORS

Here's one of the smallest precision servo motor series currently available. The new Daystrom Transicoil Type 6 Motors are wound for 26-, 33-, and 52-volt operation. Control phase is center tapped for operation with transistor drive. These Motors develop .125 oz-in. min. stall torque and 6200 RPM free speed. Each unit weighs only .9 oz. and is less than 1¼" overall.



NEW TYPE 8 INDUCTIVE POTENTIOMETER

This Inductive Potentiometer is an infinite resolution a-c potentiometer whose output voltage is linear rather than sinusoidal with the angle. Output voltage phase is dependent upon the direction of shaft displacement from null. When operated into load resistors not less than those specified, output is linear within .25% through an angular rotation of +85° through null to -85°.

NEW TYPE 8 SYNCHROS

The new Daystrom Transicoil Type 8 Synchro Line consists of transmitters, control transformers, differentials and repeaters. Dimensions equal to BuOrd Size 8. Operation: 115V 400 cycles or 26V 400 cycles. Accuracy of ± 10 minutes is standard. Other accuracies are available upon request. Corrosion resistant construction throughout. Conforms to MIL-E-5272-A. Operating temperature range is -54C to +125C. Higher temperature units also available.

NEW TYPE 11 INERTIAL DAMPED MOTOR

Here's inertial damping with no reduction in no-load speed! This new Type 11 Motor (BuOrd size 11) provides acceleration or deceleration damping in high-speed and high-gain servo systems. In non-critical applications, this motor can be used as a low-cost substitute for damping motor generators.

DATA SHEETS AVAILABLE Write for complete specifications, mechanical data, dimensions and characteristics. Be sure to ask about our New 24 HOUR SERVICE for servo motors and motor generators.

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FILTER CENTER

▶ **Solid-State Switching Device**—New type of solid-state switching device, consisting of thin layer of aluminum oxide film deposited on tiny piece of aluminum foil has been developed by Army's Diamond Ordnance Fuze Laboratories (DOFL), Washington, D. C. Device exhibits properties of capacitor with breakdown voltage of approximately 14 v., capacitance as low as 0.0005 microfarads, and a leakage resistance usually in the kilomegohm range. Upon application of critical voltage, resistance drops to one ohm or less. Compared to thyratron, new device is smaller, less expensive, more resistant to shock and vibration and high-energy radiation, and requires no power supply.

▶ **New High Temperature Resistors**—New high temperature resistive film, consisting of combination of chromium and silicon, suitable for operation at 250C has been developed by Battelle Memorial Institute. Material undergoes less than several percent change in resistance over 1,000 hr. exposure at 250C, has temperature coefficient of several hundred parts per million per degree centigrade over range of −60C to 250C, and resistances of several hundred to several thousand ohms per square can be obtained.

▶ **More Semiconductor Price Cuts**—General Electric Co. has cut price of pre-production samples of its new silicon controlled-rectifiers by 50%.

▶ **Missile Infrared Tests**—Air Force-Army-Navy project to measure infrared radiation characteristics of a variety of U. S. missiles has been completed, supplementing earlier tests on aircraft radiation conducted at Pike's Peak in Colorado. Tests were run at Air Force Missile Test Center, Florida, using both land and ship-based radiation analyzers. Air Research & Development Command sponsored program.

▶ **Two-way Dectra**—Early this year a British Valiant jet bomber made a night flight from Ottawa, Canada, over the U. S. as far south as Cape Hatteras and west to Cincinnati, using the back coverage of the pair of Dectra stations in Newfoundland as a navigation aid. Signal is said to have been good throughout the flight and accuracy high, although without a cooperating station in the U. S. track information only without range data could be obtained. Newfoundland Dectra stations are installed for evaluation of Dectra system over route between Gander and Prestwick.

▶ **Signed On Dotted Line**—Major contract awards recently announced by avionics manufacturers include:

• **Ford Instrument Co.**, division of Sperry Rand Corp., has received $14 million Navy contract for production of Mark 118 guidance computers for Tartar and Mark 119 computers for Terrier missile systems.

• **Sperry Gyroscope Co.** has received $27.5 million Navy Bureau of Ordnance contract for production of Tartar missile guidance radars and associated equipment.

• **Laboratory For Electronics, Inc.**, Boston, has received $2.8 million Air Materiel Command contract for six AN/APN-105 Doppler radar airborne navigation systems.

• **Consolidated Avionics Corp.**, Westbury, N. Y., will design and produce missile check-out equipment for Navy's Polaris intermediate range ballistic missile under new contract from Lockheed Missile Systems Division. New equipment will check continuity, leakage resistance of 2,000 electrical circuits.

• **Olympic Radio & Television** Division of The Siegler Corp. announces $700,000 contract to develop airborne and ground recording and data handling equipment for Air Force's AN/ALD-3 "Tall Tom" reconnaissance system. Olympic is a corporate associate of Hoffman Electronics.

EXPERIMENTAL TEST PILOT

position open at Bell Aircraft Corporation, Buffalo, New York. Extensive jet and fighter aircraft experience required. Formal educational background and experimental or production flight test experience desired.

Send resume of qualifications with flying time breakdown to:

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BELL AIRCRAFT CORPORATION

This announcement appears as a matter of record only.

NEW ISSUE June 26, 1958

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New York Airways, Inc.

5¼% Guaranteed Notes, 1958-63

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T53-POWERED Model 107A is testbed used by Vertol to check out design features of new helicopter, also is a demonstrator.

Vertol Unveils Twin-Turbine Model 107

By Erwin J. Bulban

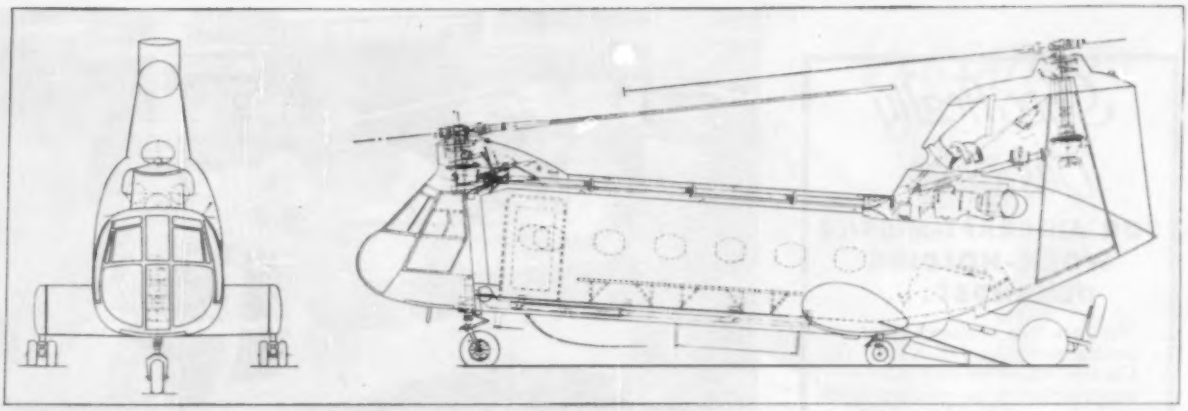
Morton, Pa.—Prototype of a new multi-turbine transport helicopter, designed to put commercial rotary-wing scheduled passenger operations on a paying basis, will be publicly demonstrated for the first time this week by Vertol Aircraft Corp. at Philadelphia International Airport.

Airline configuration of the new 160-mph. Vertol 107 (AW Feb. 17, p. 23) which the company expects to have ready for delivery in 1961, will normally seat from 23 to 25 passengers. With high-density seating, up to 30 passengers will be carried. Its military counterpart, 10 of which have been recently ordered by the U.S. Army Transportation Corps, will have provision for 22 troop seats plus troop commander or 15 litters plus two medical attendants or various cargo payloads ranging from one and a half to two and a half tons.

Army's Vertol YHC-1s should start coming off the production lines here early next year. Contract calls for delivery of seven aircraft powered by twin General Electric T58s and three with Lycoming T53s. The letter contract, awarded by Navy BuAer and funded by the Transportation Corps, totals more than $10 million.

Indications are that reason Army is favoring the General Electric-powered version is that this 1,000-shp.-plus turbine will provide the YHC-1 with higher performance capability, particularly in the single-engine condition.

MOCKUP COCKPIT (left) of Army YHC-1 shows dual control layout with instrument flight panel. Full-length transparent panels on either side of cockpit may be jettisoned for rapid exit. Cabin mockup (looking forward) has overhead roll-type door on right side.



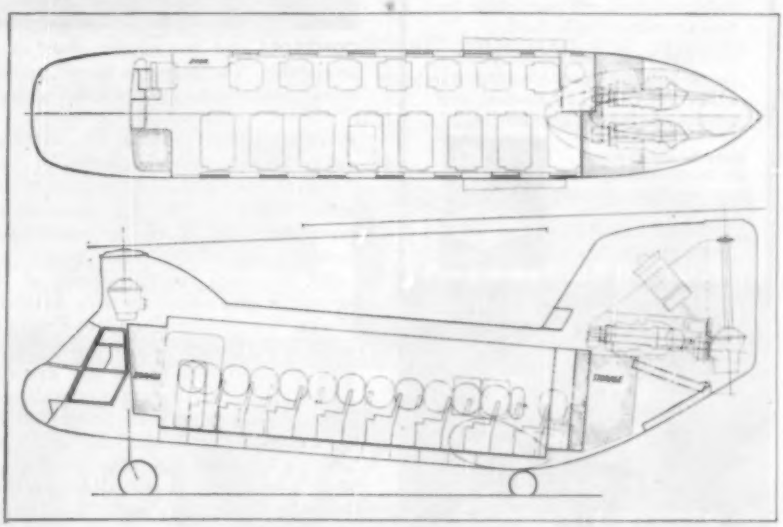
SCHEMATICS show comparison of production configuration (23-seat airliner, below) and smaller 107A testbed (above) particularly how engine drive shaft will be lowered between twin turbines with longer, vertical rotor shaft positioned in enlarged pylon.

than the Lycoming T53 can provide at its current 825-860-shp. rating.

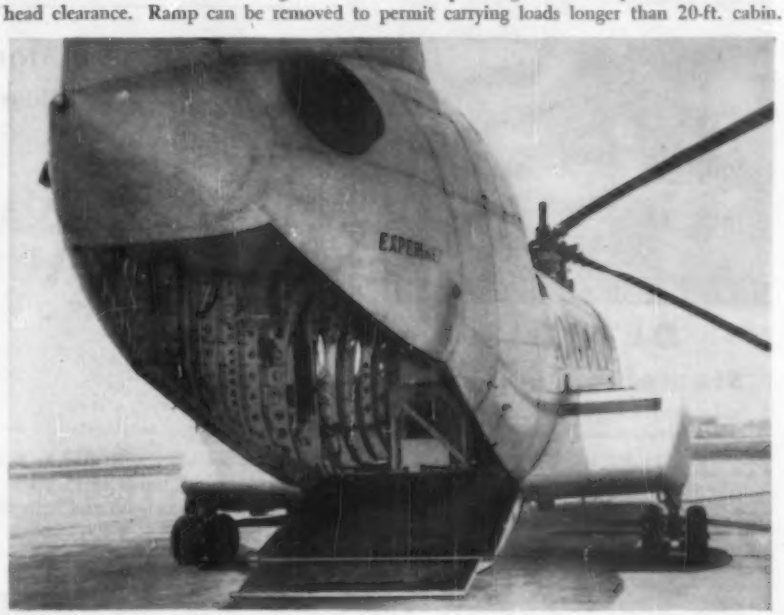
Civil helicopter operators will require one-engine-out capability in this class of helicopter and Vertol is confident that when its 107 is ready for the airline market in 1961, the T53 also will be available in the 1,000-shp.-plus class providing prospective customers with a choice of either engine.

In its airline configuration, the 107 will vie strongly with the forthcoming twin-turbine Sikorsky S-61 for position in the next generation of transport helicopters, not only among current operators, but also those who have been holding off entering the field until machines of sufficient capacity to be economically feasible become available.

Feeling at Vertol is that the new class of helicopters can be expected to have an impact on the helicopter airline industry similar to that provided by the DC-3 in fixed-wing transport operations.



REAR LOADING RAMP has hinged door retracted up to engine deck to provide 70-in. overhead clearance. Ramp can be removed to permit carrying loads longer than 20-ft. cabin.



Strong Competition

As an indication of the heat of the competitive race in which the Model 107 and S-61 are engaged, Vertol's management a little over a year ago authorized go-ahead on the project wholly with company funds. To date it has spent some $1.5 million on a development program which has eaten deeply into net profits.

Also, in an attempt to gain a jump on the competition by having a piece of demonstrable hardware flying as soon as possible, the 107A testbed configuration was produced and started its flight program in April proving out the numerous design features of the project.

Sikorsky's S-61 is not expected to roll out until next year.

Model 107A is slightly smaller than the production configuration, actually represents an early stage of the 107 development, yet is close enough to provide useful engineering test data and

CLAMSHELL doors provide access to radio compartment in 107A's nose.

separate from the fuselage in event of a crash to minimize fire hazards. All stub and fuel fittings are designed to part cleanly and not rupture the tanks.

• **To simplify maintenance,** all system items are positioned clear of the cabin to obviate need of personnel to enter the fuselage. Electrical, hydraulic, control lines and transmission are routed over the top of the fuselage, external of the cabin structure and housed in a tunnel which is completely accessible by means of hinged panels. Walkways are provided atop the fuselage on either side of the tunnel.

• **Modular concept** is utilized for all major components requiring maintenance; package replacement is planned for hub, transmissions, mixer box, controls and shaft, so that the man in the field can pull complete assemblies for overhaul or repair at rear-echelon depots rather than attempt to do this job on the spot. Vertol's goal is package replacement of any major components in 30 min. in the field. Projected maintenance man-hours for the 107 is some 60% of that now experienced with the H-21.

Few Belly Components

Only items allowed in the belly are a few ventral mounted antennas, Douglas noted. All controls are taken up on the pilot's side of the fuselage and are enclosed in a compartment for ready access, including boost actuators for the 107's hydraulic system. Portions of the controls that go under the pilots' seats will lift with removable floor sections.

All fueling is external and at ground level and all oil levels can be read using sight gages. Douglas also pointed out that the 107 will have no grease fittings anywhere in the rotor system—oil lubri-

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CONTROLS and transmission shaft are housed in tunnel atop fuselage for optimum accessibility. The numerous hinged panels provide easy access to rotor head and its various engine components, without entering the fuselage.

provides a flight vehicle for checking out production model features.

Basic layout of the 107 resembles Vertol's HUP series, the rear pylon layout providing location of the side-by-side turbines clear of the cabin area.

In discussing specific aspects of the new helicopter's features with AVIATION WEEK, Vertol Vice President-Engineering Lee L. Douglas noted that this engine position is a prime and essential factor in the 107 having a considerably larger usable cabin area (some 800 cu. ft.) than the preceding H-21—which has 600 cu. ft.—although the fuselage is eight feet shorter in over-all length than the H-21 and only eight feet longer than the HUP.

Other main points of the 107's design pointed out by Douglas:

• **Full cross-section** rear loading ramp to provide rapid loading of vehicles, including the Army's three-quarter-ton truck.

Hydraulically operated ramp, which can be controlled from the cockpit or by a cabin attendant, is designed to provide a clear height of 70 in. from the cabin down to the ground. Ramp may also be positioned at any desirable angle to permit stowage of cargo that will project from the aft end of the cabin, or that can be removed.

• **Safety feature** provides placement of all fuel in puncture-resistant bladder-type cells in external stubs designed to

Vertol Model 107 YHC-1

Military Prototype

SPECIFICATIONS:

Gross weight	15,550 lb.
Useful load	6,450 lb.
Weight empty (with military equipment)	9,100 lb.
Over-all length (blades folded)	44 ft. 3.6 in.
Height	17 ft. 7.5 in.
Rotor diameters	48 ft. 4 in.
Cabin:	
Length	22 ft. 8.4 in.
Height	5 ft. 10 in.
Width	6 ft. 7 in.
Volume	795 cu. ft.

Seating capacity:
Crew: Pilot and copilot (can be flown by pilot only)
Passengers: 22 troops or 15 litters

Engine: T-58-GE-6 (with gear reduction) rated 1,024 hp. (mrp.*) 875 (nrp.†)

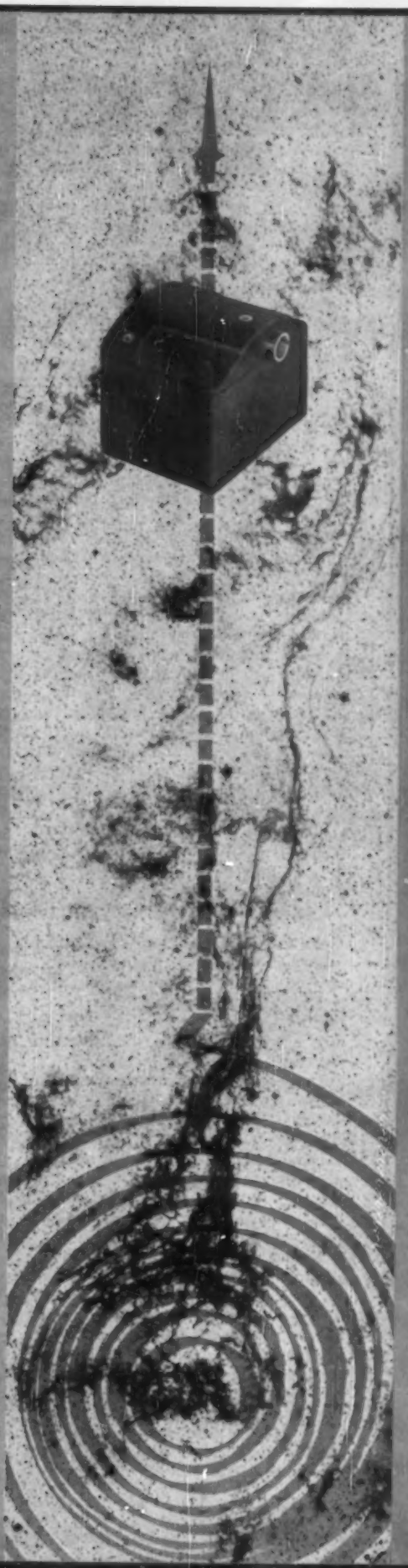
* mrp.—Maximum rated power
† nrp.—Normal rated power

ANNOUNCING:
the Revolutionary Whittaker Spring-Driven Gyro!

BACKGROUND:
Quantity production of missiles and target drones with flight times of 45 seconds to 10 minutes brought a demand for a low cost mechanically driven gyro that could reliably and accurately serve the functions of roll, pitch, and yaw control.
The goal of Whittaker's development program was to match or exceed the performance of electrically driven gyros, at ¼ to ⅓ the cost.
Problem areas are solved, including
(a) method of energizing, which Whittaker solved with a manually wound helical spring
(b) rotor design, where Whittaker is using a relatively heavy rotor turning at low speeds
(c) method of transmitting power instantly to the rotor
(d) structures and packaging.

PERFORMANCE:
The first operational unit, which was designed for a flight time of 2 minutes, was so successful that it brought an immediate demand for new applications, and more rigid specifications. Spring-driven gyros are now being built at Whittaker for 10 minute flight times, with drift rates of 0.625° per minute, angular freedom to 360° on the outer gimbal and ±85° on the inner gimbal, and environmental capabilities which include shock to 100 G's, vibrations of 20 cps to 2000 cps at 10 G's, and linear accelerations of 30 G's.

AN IMPORTANT ADDED ADVANTAGE:
the gyro is armed and caged at the factory, and hermetically sealed for instant readiness in the field. Starting time ranges from 0.1 to 0.5 seconds.



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romagnetic, ferroelectric, electroluminescent and cryogenic materials is already being developed into new technologically significant devices. Thus we have ample reason to believe that there is being generated now, and will be in the future, research knowledge that will create an even greater solid state technology than one can see by simple extrapolation of the present."

Gordon K. Teal, Texas Instruments assistant vice president and director of research, told the group that transistor electronics is now reaching maturity. He said there is enough variety in device types and enough experience in their use that "we are no longer flooded by requests for new specific types."

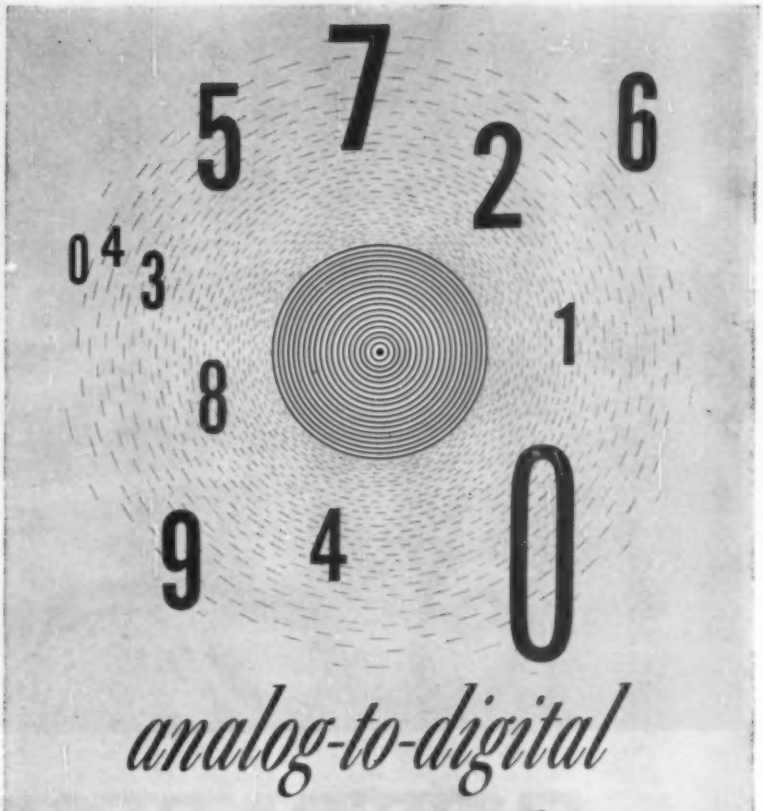
Efforts are now being concentrated on achieving reproducibility within narrow specifications, improving certain parameters, increasing reliability and cutting cost. Teal observed that surfaces are being studied intensively and that it is believed that some of the research tools and techniques now employed will bring deeper understanding, improved processes and techniques and better performance.

Teal noted that while the major part of transistor and rectifier effort is centered on germanium and silicon, intermetallic compounds offer possibilities of improved operations. He listed indium phosphide and gallium arsenide as materials that theoretically might operate satisfactorily up to 300-450C and said that gallium arsenide, because of its high carrier mobilities, might be expected to be superior to silicon for high frequency transistor operation.

Noting that for broad application, transistors must have a functional capability over a wide frequency range, Mervin J. Kelly, president of Bell Telephone Laboratories, said that present semiconductor technology permits design of transistor structures which can operate over a frequency range of 1,000 mc. Recent research has demonstrated an extension of this range to 6,000 mc., Kelly said, and it now appears possible that semiconductor amplifiers will be realized that can operate at frequencies as high or higher than those of advance design electron tube structures.

Power capabilities of 50 watts have been realized at the lower frequencies, and Kelly estimates that the power requirements of about 80% of existing electron tube applications can be handled by transistors with the current state of the art. Combining frequency and power limitations, Kelly estimates that at least 70% of present electron tube applications are technically vulnerable to semiconductor penetration.

Kelly told the group that more than functional adequacy is needed to accomplish this penetration of 70% of electron tube applications. He said the



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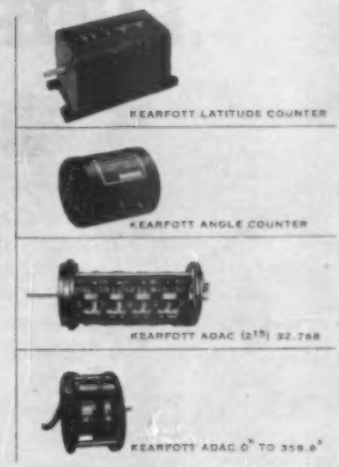

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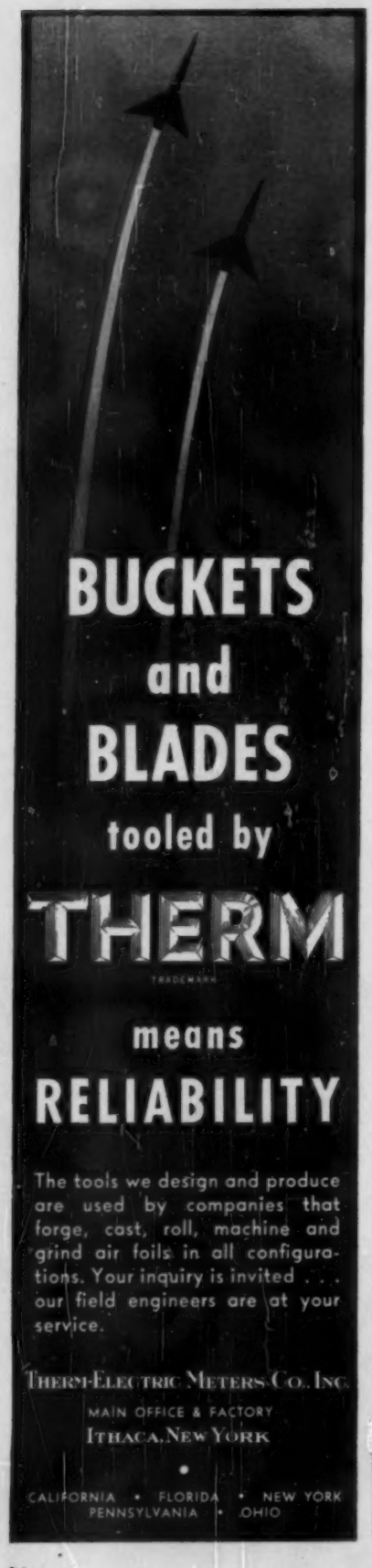
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cation will be used throughout, with seals being permitted to "weep" and collect oil in traps. This system has been found very effective on the rotor pitch bearing housing of the H-21, he reported.

Whereas on the H-21 each rotor transmission has its own integral cooling system, a single blower—in the rear pylon—will cool all oil for the 107's transmission system.

Forward rotor head, with its wiring, plumbing and cooling unit, will come off from top of the helicopter, the rear rotor head system will be removable through the engine deck, which extends across the top of fuselage.

All-metal interchangeable rotor blades will incorporate electrically cyclic deicing system utilizing .050-in. rubber boots which has been tested successfully at Air Force's Eglin AFB climatic hangar and at Mt. Washington, Mass.

With a major portion of the fuselage structure of constant-diameter section, Vertol expects important economies in production—it is believed that the 107 structure will take some 15% fewer man-hours to build than the H-21. Fuselage will be conventional structure of aluminum alloys with titanium used in engine hot area.

In addition to rear loading ramp, the 107 also has a door forward, on the right side just behind the cockpit, of the overhead rolling type to provide better watertight integrity than the side-slide type.

Fuselage is designed for amphibious capability—Vertol expects to have the 107 certificated to operate in Sea State 3 normally (the V-44 has similar capability); by adding inflatable bags to the tips of projecting stubs, to provide additional lateral stability, the new helicopter is expected to be capable of operating in Sea State 4.

Cockpit will be provided with full dual all-weather instrumentation, if desired, including autostabilization equipment, either the Vertol-developed mechanical stabilization augmentation system or an electronic autostabilization equipment.

One of the features included in the military version is a seat for the troop commander located behind and between the pilots so that the commander can maintain close contact with the flight crew during assault operations and his men. Crew and troop commander also have communications with the troops via a loud-speaker system. This close liaison between flight crew and troop commander has been proven a necessary feature in French combat experience with the H-21 in Algeria.

Fuselage also incorporates a panel in the floor for greater ease of hooking onto externally carried cargo; this method permits a man in the cabin, using a boat hook, to engage cables tied to cargo, draw them up and connect them to the cargo sling, obviating need for a man on the ground.

Vertol foresees considerable stretch possible with the present 107 configuration and indications are that future, larger models will maintain current, rear-ramp loading configuration.

Killian Stresses Creative Research

Dallas—More critical appraisal of the quality of U. S. research effort is necessary to make sure that research is as creative and productive as possible, according to Dr. James R. Killian, Chairman of the President's Advisory Committee on Science.

Calling for greater emphasis on quality in the national research effort, Killian said "we can no longer accept all research on faith, or believe that research, just because it is called research, is bound to be good." He spoke by leased wire from Washington at the dedication of a new Texas Instruments semiconductor plant here.

Killian also said that the quality of research depends on proper allocation of effort and money between research and development categories. He said that too much emphasis is given to development and too little to basic research. In the area between basic research and development, Killian said there are deficiencies in supporting research work which, if done more thoroughly, could avoid costly mistakes in hardware development.

At a symposium on solid state devices held at the Texas Instruments plant, industry experts predicted significant expansion of the use of semiconductors based on the current state of the art. J. A. Morton, director of development for Bell Telephone Laboratories, told the group that with the addition of diffusion-silicon technology, the basis for a significant development effort exists right now.

Morton said that the current body of knowledge is complete enough to almost guarantee that a three to five year development effort should improve reliability and cost factors which are "paramount to the creation of large, complex systems for military and industrial use."

Despite the present capability for expansion, Morton pointed out that continuing research can be expected to produce new knowledge and new inventions in the field.

Transistor electronics is the leader of a broader field of solid state electronics to come, Morton said. "Some of the newer knowledge of the physics of fer-

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Future aircraft and missiles may require propulsion systems far different from those in wide use today —different in size, power output, appearance and perhaps even in the basic method of utilizing energy.

To probe the propulsion future . . . and to build and test greatly advanced propulsion systems for coming generations of flight vehicles, Pratt & Whitney Aircraft is now operating its new Florida Research and Development Center. This facility supplements Pratt & Whitney's main research and development installations in Connecticut.

The new Florida Center, financed and built by Pratt & Whitney Aircraft, is unique in America's air industry. Here a completely air-conditioned plant with 17 acres under roof is specially designed and equipped for the development of new power plants of virtually any type. Testing is handled in special isolated areas; the nearest is four miles from the plant and many miles from any inhabited area. The new Center can be greatly expanded on its 10-square-mile site. Continued isolation is insured by a vast wildlife sanctuary in which the Center is located.

Today about 1800 people are employed at the Center, of whom about half are scientists, engineers and highly trained technicians. By late next year, a total of about 3500 employees is anticipated.

The new Florida Research and Development Center is one more reason why Pratt & Whitney Aircraft is able to continue producing the world's best aircraft propulsion systems . . . in whatever form they take.

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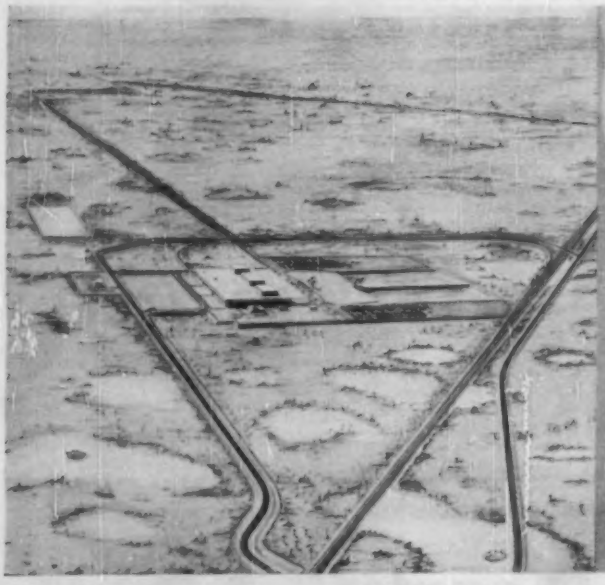

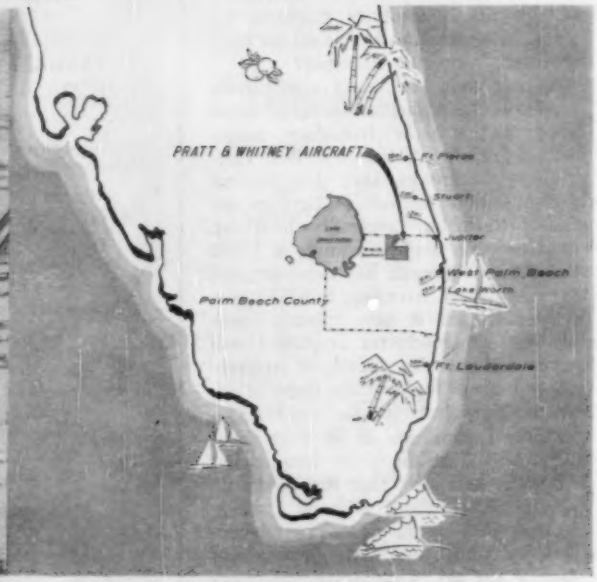

ISOLATION—Ten square miles comprise the site of Pratt & Whitney Aircraft's new Florida Research and Development Center. Experimental shops and offices covering some 17 acres are in the foreground, while the tests areas, barely visible in upper left, lie four miles in the background.

LOCATION—The new Center is located at United, Florida, midway between West Palm Beach and Lake Okeechobee, in the upper Everglades area. It is almost surrounded by a wildlife sanctuary. Most employees live in the cities and towns along the east coast of Florida, driving to the Center on excellent new highways.

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present state of reliability, length of life and cost of production are inadequate for successful competition in many areas.

Effective understanding and control of surface effects was cited by Kelly as a key to overcoming these shortcomings. Right now, reliability and long life can be obtained by controlling the surface, but the processes required cost so much they limit the areas of application. Understanding of surface effects is expected to come with continuing research, and resulting low cost processes will permit massive application.

Discussing costs, Mark Shepherd, Jr., vice president of the Semiconductor-Components Division, said that mechanized production techniques, along with new device developments, will cut manufacturing costs over the next decade and that these cuts will be passed on to the customer. He predicted that the full impact of mechanization will be felt by 1965, and that this factor, plus such developments as the glass transistor which a few firms have already built, will cut germanium transistor prices to a point where they are directly competitive with vacuum tubes on a cost basis.

Shepherd said that silicon transistor prices will also fall as production economies are realized. He pointed out that average price of these devices has dropped 60% in the last four years and predicted that the downward trend will continue.

Manufacturer Denies P.16 Design Charges

Geneva—Flugund Fahrzeugwerke Altenrhein (FFA), designers of the controversial Swiss P. 16 ground-attack airplane, have denied charges made by Military Minister Paul Chaudet (AW June 16, p. 297).

FFA told AVIATION WEEK that the contract between them and the responsible government agency (KTA: Kriegstechnische Abteilung) was based on British requirements accepted by the Swiss as design criteria.

Company said it had informed KTA of changes in design, also as required by contract.

Company is still trying to get a canceled order for 100 P. 16s reinstated. It was canceled by decision of a seven-man federal council less than three months after the order was placed by a majority vote of parliament. Reason cited for the cancelation was that a delivery delay was expected, due to redesign of the plane's hydraulic system which was blamed for the accident to the third prototype.

Major contention centers around the aircraft's hydraulic servo-control system. Basic airplane hydraulic system follows British requirements and uses British and U. S. components.

Concept of the servo-control system is the Leduc-Jacottet type of French origin.

Pumps, accumulators and high-pressure lines of the servo-control system are duplicated, but surface actuators and return lines are not. Design of the system has met British requirements, company says.

There is some possibility of interaction between systems in event of failure in one system, because they share common return lines. In the case of a return line failure the control system maintains enough fluid for a return to base. In the Leduc-Jacottet system the only fluid pumped is the amount needed to actuate a control surface. There is no constant leakage flow as in some other types of systems.

P. 16 accident has been traced to an interaction between the main airplane hydraulic system and the suction side of a pump of the servo-control system. Primary cause of failure was not in the servo-actuator system nor dependent on it.

FFA technicians plus other Swiss and foreign experts have been able after rigorous tests to duplicate the cause and sequence of the accident.

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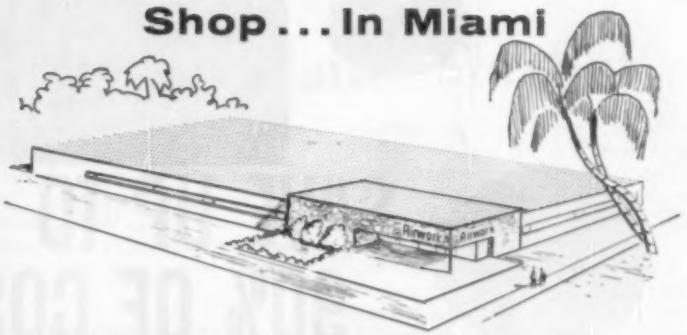

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ITALIAN Nibbio four-seater has a gross weight of 2,550 lb., cruise speed of 189 mph. Lycoming 0-360 is rated at 180 hp.

Nibbio Aims at 'Second Plane' Market

By David A. Anderton

Milan—Aviamilano's F. 14 Nibbio four-seat executive transport is being offered as a "second airplane" to companies already operating larger and more expensive twin-engined business aircraft.

This sales concept is in addition to the company's normal effort to sell the airplane for what it is—a light transport designed for European business use. But their "second plane" idea, similar to the arguments advanced by manufacturers of small European cars, seems to recognize tacitly the tough competition they face on the executive market from American planes. Aviamilano says the Nibbio is not in a category with the big American twin-engined executive airplanes, but that its performance and economy will make it a worthwhile investment as an alternate when only two or three people have to make short trips by air.

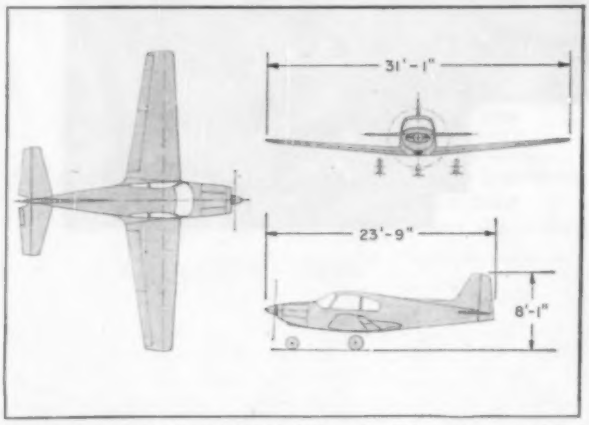
Company Guaranty

The company guarantees a 189-mph. cruise speed, and—if flown 600 hr. per year by a professional pilot—an annual operating cost of just over three cents per passenger mile.

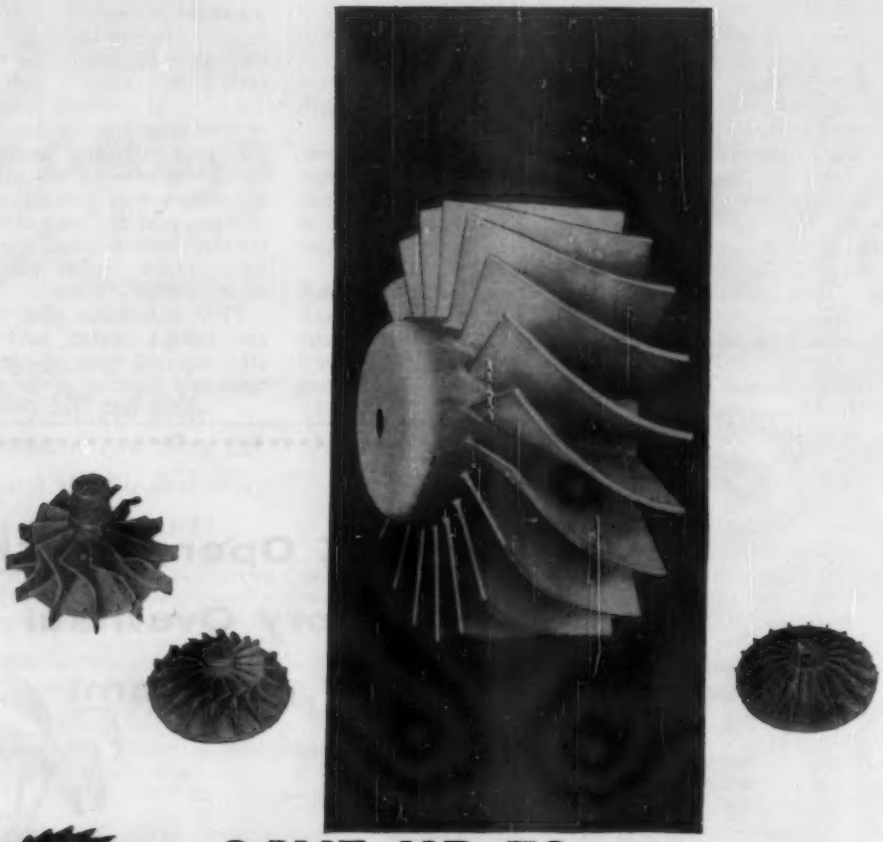
Airplane meets both Italian and U.S. airworthiness requirements in normal category. Price is $16,800 from Milan, and optional radio equipment such as 24-channel VHF and radio compass will raise the final equipped price to $20,000.

All cost figures are based on current prices in Italy, which are almost directly comparable to U.S. prices.

Nibbio is one of a progressive family of sport and executive airplanes designed by Stelio Frati, well-known Italian aeronautical engineer and professor at the Politecnico di Milano. Direct predecessor of the Nibbio was the F.8 Falco, a single-engine two-place sport



CABIN size of Nibbio (left) is 3.6 ft. wide, 7.5 ft. long and 3.9 ft. high. There is luggage space behind the rear seat which can be reached during flight. Controls (right) are all within easy reach of the pilot. Pilot position and instrument layout are conventional.



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Alcoa® Premium Castings permit enormous savings in the production of aircraft components which formerly required extensive machining. For example—some especially complicated impellers cast in aluminum have resulted in savings of 90 per cent, or $1,000 less than machined pieces. And they meet every requirement for high strength and smooth surface finish.

Impellers are exacting items. They spin at tip speeds up to 2,500 fps (60,000 rpm for a 9½″ diameter part). Cast with Alcoa premium-strength C355-T61 aluminum alloy, properties are *guaranteed in the casting*. The smooth, curving blades, often tapering to a delicate 1/32″ edge, have .005″ to .010″ tolerances. Even difficult shrouded impellers with cored air passages, which are cast with a surface finish guaranteed to 125 microinch maximum, actually run 50 to 90 microinches in most cases.

Alcoa has steadily been refining its ability to produce high-speed rotating parts since 1944. Research through spin-testing, stress analysis, high-strength plaster cast molding and new alloys has evolved this unique process with exceptional cost savings.

The premium-casting process, so successful with highly stressed impellers, is an exclusive Alcoa development. For information about saving on your machining costs with Alcoa's premium-casting process, call your Alcoa sales engineer. Or write Aluminum Company of America, 1800-G Alcoa Building, Pittsburgh 19, Pa.

Mechanical Properties of Alcoa C355 Premium-Strength Castings, Spec. MIL-C-21180, Type IIa for highly stressed regions are:

	Guaranteed Min.	Typical
UTS, psi	44,000	47,000
TYS, psi	33,000	36,000
EL, %	3.0	6.0

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

"ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings

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Under the water . . . on the water . . . on land . . . in the air . . . and out into space . . . in all these areas Hughes advanced technology is being applied to vital military and commercial electronics projects.

In the space satellite field, for example, Hughes is active in the preliminary design of guidance and control systems, communication and telemetry systems, and sensing devices using infrared, optical and radar techniques.

Responsible for guiding and formulating the advanced systems concepts that make this new product diversification possible is the Systems Analyst. His creative thinking has motivated such new Hughes projects as advanced ballisitic missile guidance, space vehicle systems, and tactical missile systems. Other new programs initiated by Hughes Systems Analysts include advanced radar systems for all areas of military and civilian applications, including AICBM, missile guidance, early warning, air traffic control; and integrated electronics systems for undersea warfare.

Currently the Hughes Research and Development Laboratories are engaged in the greatest expansion in their history. Professional opportunities have never been more promising, especially in the more senior areas such as Systems Analysis.

Other Hughes activities are also participating in the expansion. Hughes in Fullerton is developing and producing advanced three-dimensional radar systems. Hughes Products, the commercial activity of Hughes, is producing an electronics system which automates a complete line of machine tools.

Today Hughes offers Engineers and Physicists the opportunity of locating with an established firm and working in advanced new technical fields.

The wide range of activity at the Hughes Fullerton facility extends from basic data processing and surveillance radar research through final design and packaging.

Ferromagnetic studies conducted by the Hughes Research Laboratories include fundamental research in the physics and chemistry of ferrites, synthesis of ferrite materials and development of ferromagnetic devices.

New commercial and military contracts have created an immediate need for engineers in the following areas:

Circuit Design	Aerodynamics
Reliability	Vacuum Tubes
Communications	Crystal Filters
Microwaves	Systems Analysis
Nuclear Electronics	Computer Engineering

Write in confidence to Mr. Phil N. Scheid,
Hughes General Offices, Bldg. 6-J, Culver City, California.

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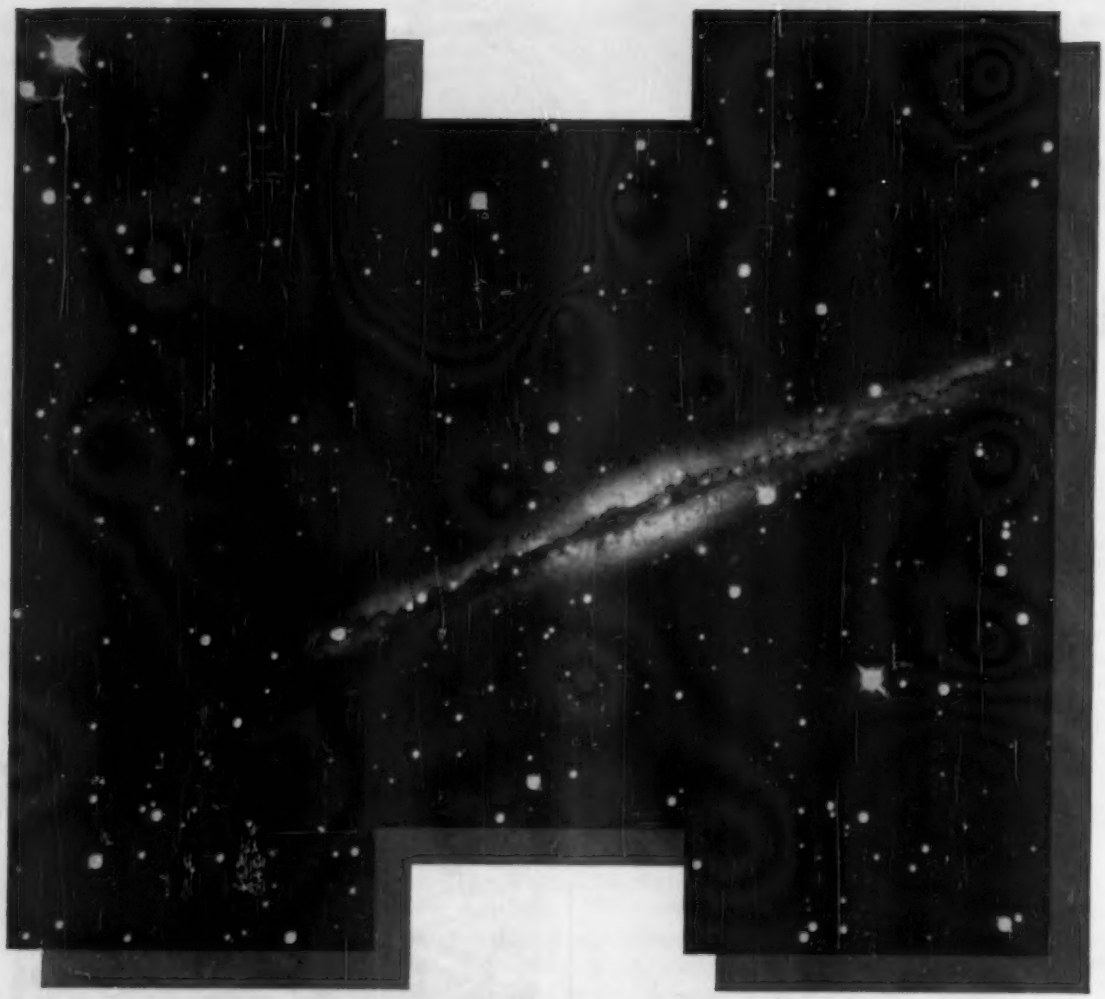
Creating a new world with ELECTRONICS

HUGHES

HUGHES AIRCRAFT COMPANY
Culver City, El Segundo,
Fullerton and Los Angeles, California
Tucson, Arizona

THE SKY IS



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RESISTORS*
Crafted with Precision for Reliability

For critical military and industrial applications.
Hermetically sealed by bonding glass-kovar headers to high thermal, shock resistant glass housings. 100% humidity-proof.
NETWORKS' new, truly accurate, precision Resistors are available in ¼, ½, 1 and 2 watt ratings at 105°C ±0.1 to 1%. Units for 125°C available on special order. Lug types or flexible leads. Test results prove substantial improvement over MIL specs. They combine remarkable stability, under load and on the shelf, with exceptionally low temperature coefficient.
*Patented

Reliability
Conservative Ratings
Stable Characteristics

NEC
Engineering Bulletin with complete specifications available upon request.

NETWORKS ELECTRONIC CORPORATION
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plane that excited much interest all over Europe.

The F.14 follows the Falco formula and is primarily a scaled-up version of that airplane. It is a single-engine four-seater all-wooden airplane with plywood and fabric covering. Powerplant is a Lycoming 0-360 rated at 180 hp., driving a Hartzell constant-speed propeller. Fuel is 90/96 octane, carried in two wing tanks and one fuselage tank with a total capacity of 55 U.S. gal.

Gross weight of Nibbio is 2,550 lb. This figure is also the maximum landing weight. Empty weight is 1,500 lb. Normal wing loading is 18.4 psf., and power loading is 14.15 lb./hp.

Fuselage structure is monocoque, and is broken down into two sections bolted together. Cabin size is 3.6 ft. wide, 7.5 ft. long and 3.9 ft. high. There is luggage space behind the rear seat which can be reached during flight.

Pilot position is conventional, as is the instrument layout. The cabin is large, and controls are all within easy reach of the pilot.

Wing profile is NACA 64000 series, with 13% thickness ratio at the root and 10% at the tip, and a 4-deg. washout. Wingspan is 31.2 ft., and area is 128 sq. ft. Plain flaps are fitted.

Tricycle landing gear is electrically retractable with a mechanical standby system.

First impression on entering the Nibbio is that of roominess and neatness of the entire cabin layout. Cockpit checkout is routine and simple. For taxiing, about 2,000 engine rpm. breaks the plane loose and moves it easily on grass; an additional 200 rpm. makes 90-deg. turns possible. With nosewheel steerable by the rudder pedals, ground maneuvering is easy.

Takeoff Data

In takeoff with 20-deg. flap deflection, nosewheel leaves the ground at an indicated 47 mph., and the plane is airborne at about 65 mph. Corrected takeoff distance is 590 ft.

Climbout after takeoff with maximum continuous power and the airplane in clean configuration is 1,200 fpm. at an indicated airspeed of 109 mph. With cruise power this rate is reduced to 700 fpm.

Static and dynamic stability is positive and characteristics are good.

Stall warning is a buffeting that starts about 10 mph. above the stall; loss of altitude is not more than 100 ft.

With power on and the airplane dirty, the stalling speed is 51 mph.;

Chemical Dispenser in Production

Airfoil-shaped perforated dispensing unit, mounted under wings of Stearman agricultural airplane, is designed to permit pilots to spray, dust, seed or fertilize by simply resetting a cockpit control, obviating need for time-consuming equipment changeover. Swath rates may be varied from 33 ft. to 100 ft.; flow rates can be modified from one to 180 gal./acre, the producer of the new Swathmaster dispening unit, Transland Aircraft, reports. Designed by veteran aerial applicator Joe Sellers, Swathmaster consists of a stainless steel, corrosion-resistant assembly made up of two outer panels and a center section in which material is mixed and agitated. In the front of the unit is an air intake taking 100 cu. ft. of ram air/sec. On top of the unit are perforations for dispensing dust and liquids; undersurfaces are louvered to release pellets and seed. Complete installation weighs about 115 lb.

ROLLS-ROYCE DEVELOPMENTS

Air Cooled Turbine Blades in Service

The latest Rolls-Royce Avon turbo jet engines in squadron service have air cooled turbine blades. This feature permits the use of higher gas temperatures, giving an increase in thrust per pound of engine weight, without affecting blade life.

The proving of this advanced feature in squadron service has established its basic reliability and air cooled turbine blades will be incorporated in the later marks of Rolls-Royce turbo jets and prop-jets for civil air transport.

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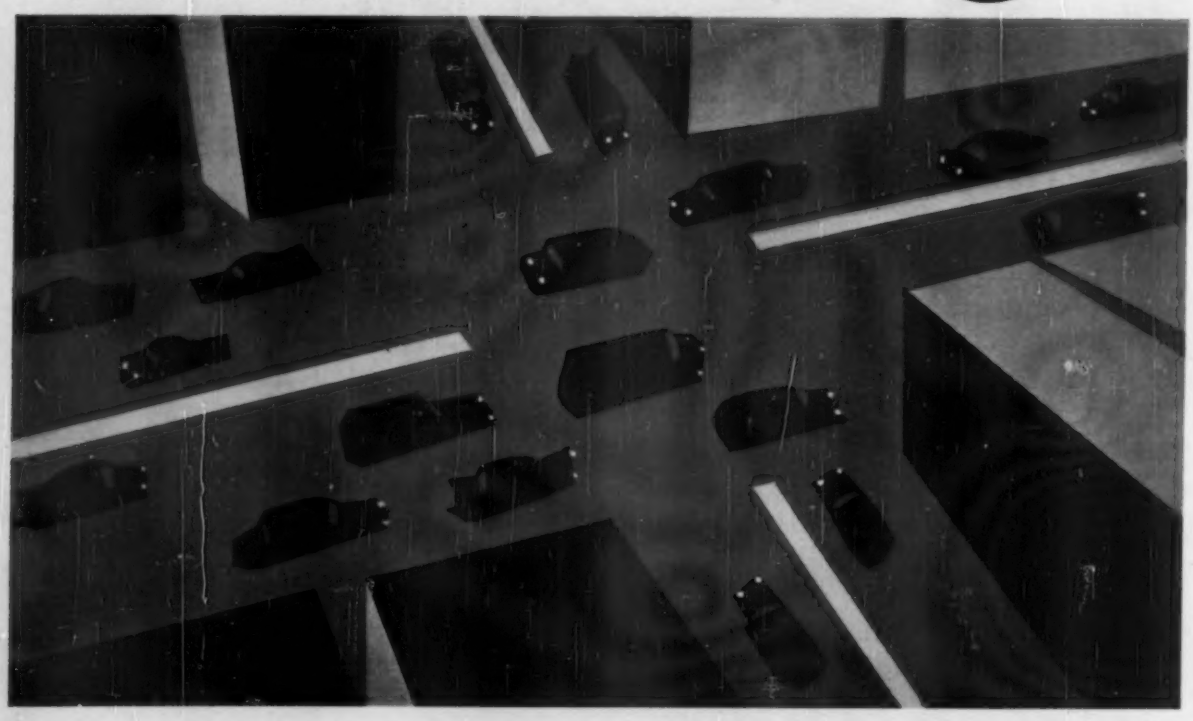


Air Surveyor

Aero Commander 680 Super light twin business plane is being readied by Spartan Air Services, Ottawa, for extensive aerial survey of Canada's maritime provinces. Using Decca control, the 680 Super will fly more than 700 hr. this summer covering more than 110,000 line miles utilizing double three-man crews. Plane has magnetometer mounted in tail boom, radio altimeter, Sperry C-4 Gyrosyn compass, Hamlyn HTR-10 high-frequency communications radio, dual ARC radio compasses and Narco Sapphire VHF radio. An Aeropath continuous strip film camera is mounted in the cabin floor.

with power off, the same configuration stalls at 55 mph. Stalls are gentle and recovery is almost self-initiated by the airplane.

Full-throttle level flight runs produce a maximum speed of 205 mph. Maximum cruise speed is 192 mph., normal cruise is 189 mph., and most economical cruise is 168 mph. at 5,000 ft.

In the pattern, gear is lowered below 124 mph., and the flaps go down at about 112 mph. or less. Normal pattern speed is about 93 mph., and after flareout, the airplane touches down at about 59 mph. Landing run corrected is 490 ft.

The company guarantees a range of over 800 mi. at maximum takeoff weight, and the ability to climb over mountains of 17,000 ft. which covers European operations by a safe margin.

Cost Accounting

Aviamilano calculates cost of Nibbio operations in the usual manner, using figures that apply in Italy. While exact comparison with U.S. prices is not possible, the over-all differences aren't too much and can be easily found.

For example, the salary for a professional pilot in Italy is lower than in the U.S.; in balance, fuel and oil prices are higher in Europe than in America.

Cost analysis assumes that the airplane is fully equipped, valued at $20,000, that total utilization is 600 hr. flown per year at a block speed of 189 mph., and that the airplane is depreciated over a five-year period with 20% residual value at the end of that time.

Certain costs remain common to the analysis regardless of whether or not the plane is flown by a professional pilot. They are: fuel and oil at the average European price, $3,750; depreciation, $3,200; hangar rents and landing fees, $400; compulsory insurance (liability), $125; inspections and controls, $160. Miscellaneous costs, which include charts, supplies, aero club dues, etc., come to $960 for the private operator, and $480 if a professional pilot is hired.

With a professional, salary is figured at $4,810 per year and aircraft and engine maintenance at $1,280. Total annual cost is therefore $14,205, which breaks down into operating figures of $23.68 per aircraft hour, 12.5 cents per aircraft mile, and 3.1 cents per passenger mile.

Without a professional pilot there is no salary allotment, and the aircraft and engine maintenance is increased to $1,840. Total annual cost is therefore $10,435, which breaks down into operating figures of $17.39 per aircraft hour, 9.2 cents per aircraft mile, and 2.3 cents per passenger mile.

PRIVATE LINES

Lockheed Jetstar Prototype No. 1 recently made round-the-U.S. speed flight in under 18 hr., covering the four-cornered 6,700-mi. trip in 14 hr. 50 min. flying time at an average speed of 456 mph. Top speed was 686 mph. Flight pattern was from Edwards AFB, Calif. to McChord AFB, Wash., to Chicopee Falls, Mass., to McCoy, Fla., and back to Edwards. Much of the flight was at 45,000-46,000-ft. altitudes. Plane was fitted with 640-gal. glove tanks on wings, extending range from 1,730 mi. to over 3,000 mi. Second of the Jetstar prototypes has been on a nationwide demonstration tour to corporation executives.

Former Clewiston (Fla.) Royal Air Force training base is being converted into an air motel for flying fishermen visiting Lake Okeechobee area. Swimming pool, tennis courts and other sports facilities are available.

Shipment of 655 utility and business aircraft was made by nine companies during April for a total dollar volume of $10,399,000 compared with 656 units valued at $10,592,000 the previous month. April deliveries included 548 aircraft of four-place or more, of which 96 were twin-engined. For first

"L·I·F·E" with LEAR

By BOB MAYS

My job is flying and demonstrating the LEAR L-5/LIFE equipment. This, you will say makes me prejudiced. To this, I agree, because day after day I see many people, including all types of pilots, engineers, etc., who "wring-out" this equipment and come up with nothing but praise.

On my "check-out" flight in a twin aircraft I'd never flown before, using LIFE I'd never seen before, I completed two of the best ILS approaches I've ever made. Next, I made an automatic approach with the L-5 autopilot which was even smoother than the one I had done manually. I especially liked being able to monitor the entire approach on LIFE while the L-5 autopilot did the job.

The L-5/LIFE combination is a great relief to me, especially when I'm flying as a one-man crew. I am free to monitor engine instruments, navigate, communicate, and best of all in this day of heavy traffic density, watch out for other aircraft—greatly decreasing the chance of collision.

The NAFLI ATTITUDE/COMMAND INDICATOR gives me a clear and *natural* presentation of my aircraft's attitude at all times. And in ILS approaches I simply follow its *command* signals for smooth, precise interception of the localizer and glide slope.

The SITUATION DISPLAY INDICATOR pictures my position in relation to the localizer beam, VOR radial or selected track—in the meantime, the L-5 holds my assigned altitude and flies the heading or track I have chosen.

To fly an airway, I merely push two buttons, and I automatically maintain my desired altitude and track. Even my *wind correction* is figured automatically and compensated for me. And the SITUATION INDICATOR shows me my exact crab angle due to cross-wind.

I often fly long hours, and the L-5/LIFE combination allows me to arrive at my destination far less fatigued and therefore mentally alert to approach and land, which is vitally important.

Because of L-5/LIFE's simplicity and reliability, I have lowered my personal minimums considerably—it has taken all the sweat out of low visibility ILS approaches.

Holding patterns, weather and clearances are no longer a three-man job. I receive and transmit clearances while flying a holding pattern by merely turning a knob or pushing a button.

All kinds of people have flown "LIFE"—a 15,000 hour airline captain—private pilots, both IFR and VFR—and their praise was unanimous.

In conclusion, this L-5/LIFE combination is not only wonderful to fly, but a real thrill to demonstrate. As the French say, "C'est la vie"... THIS IS "LIFE"!*

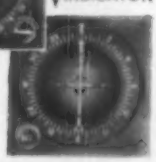
Bob Mays

L·I·F·E

*Lear Integrated Flight Equipment

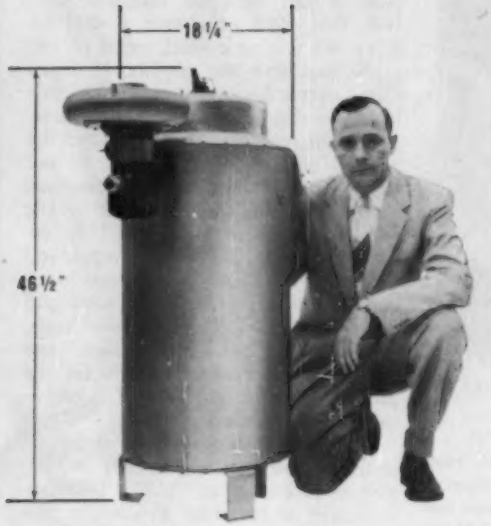
LEAR NAFLI INDICATOR →

LEAR SITUATION DISPLAY INDICATOR ↓



Write, wire or phone for a demonstration at your home base:

LEAR *L-5/LIFE*
3171 South Bundy Drive
Santa Monica, California



million btu/hr!

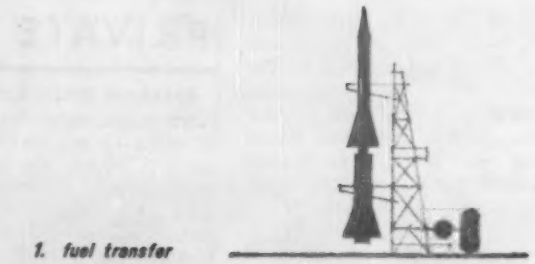
For missile ground support applications this compact new Janitrol liquid heater delivers heat up to a rate of 1 million Btu/hr. A complete variable output heating system, it automatically maintains liquid at any desired temperature . . . reliably.

This 257 pound package is ideally suited to such applications as heating missile fuel during storage and transfer, vaporizing liquids, and in a wide variety of support vehicles and buildings. For both material and personnel comfort heating the new Janitrol liquid heater is a simple, trouble-free way to get large quantities of controlled heat.

Heater burns either diesel fuel, gasoline, or JP-4, and can be converted with a simple adjustment. Radio noise shielding meets military specifications. It will operate in extreme environments to −65°F.

Janitrol's new liquid heaters may be used individually, or in multiples to meet virtually any heat requirement.

Wherever heat is needed in missile support equipment Janitrol may already have what you need. Contact your Janitrol representative now for the full story on liquid heaters. Janitrol Aircraft Division, Surface Combustion Corporation, Columbus 16, Ohio.



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. . . a regulated lightweight inverter, built to aircraft and missile specs.

FEATURES

- Constant output voltage as battery discharges.
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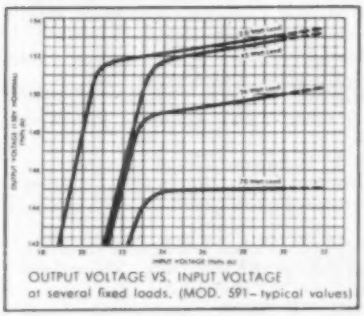
- Withstands short circuit indefinitely.
- Withstands input voltage transients of 70 volts for 0.1 sec. and 60 volts, indefinitely.
- Output voltage drift only 1.5% from −55° to +71°C.

SPECIFICATIONS

D. C. OUTPUT Model 591-A
Input Voltage: 24-30 VDC
Output Voltage: Any from 25-1200 VDC
Output Power: 60 watts regulated
Regulation: Line: ±0.5% for 6V variations
Load: ±1.0% for ½ L to FL
Ripple: 0.3% RMS
Size & Weight: 3" OD x 3 1/16" high; 22 oz.

A. C. OUTPUT Model 591-AC
Input Voltage: 24-30 VDC
Output Voltage: 115 VAC, 400 cps, 1 phase
Output Power: 50 V.A. square wave
Regulation: Frequency: ±0.5%
(line & load) Voltage: ±2.0%
Size & Weight: 3" OD x 3 1/16" high; 22 oz.



OUTPUT VOLTAGE VS. INPUT VOLTAGE at several fixed loads. (MOD. 591—typical values)

Write or phone for literature

ARNOLD MAGNETICS CORPORATION
4613 W. Jefferson Blvd.
Los Angeles 16, Calif.
REpublic 1-6344

four months of 1958, business plane builders have shipped 2,315 airplanes valued at $37,851,000 compared to 2,200 valued at $35,970,000 shipped for the first quarter of last year.

Scene of 16th National Plowing Contest & Conservation Exposition Aug. 22-23 will be Hershey, Pa., where plans are being made to accommodate up to 400 visiting aircraft under DC-3 size near the 2,500-ft. grass airstrip between Hershey Stadium and Milton S. Hershey School. International Harvester plans to invite 5,000 members of National Flying Farmers Assn.

Helicopter service has been established between Municipal Airport, downtown Buenos Aires and Ezeiza International Airport with flights operating from 3 to 6 p.m. Two-passenger Bells are being used currently, but the operators are currently considering using eight-passenger types. Trip between the airports by helicopter takes 15 min.

Safe Flight Instrument of Canada has opened production, repair and overhaul facilities at Toronto Airport, Malton, Ontario.

Dutch Kolibrie ramjet helicopter (AW Apr. 28, p. 85) sowed 40,000 acres with reed in 80 flying hours and also sprayed 3,000 acres in 40 flying hours with weed killer dispensed from its special 50-ft. boom, providing 70-ft. swath. Operation is part of reclamation project by the Wierinermeer Directorate, an official organization which purchased one of the first Kolibries.

NARCO CS-5 cross pointer indicator, used in conjunction with VOA-3 omni converter tied to the Sapphire 1016, 1016A or 1021, will provide pilot with six information functions: VOR, ILS localizer guidance, glide path indication, to-from flag, selected and reciprocal course information plus fail-safe flag alarms. Indicator fits a standard three-inch instrument cutout and is 2¼-in. deep. CS-5/VOA-3 combination weighs under six pounds, will be available late this summer, costs $685. Earlier CS-3A, which did not include glide slope indication, is now priced at $485.

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for circuits required to operate in 2000° F. flame for fifteen minutes. Excellent for fire-detector circuits and for use in temperatures up to 600°F.

HIGH TEMPERATURE CABLE...

Suitable for operating temperatures up to 650° F. with nickel-clad copper conductor and laminated insulation having superior dielectric strength and moisture resistance. In AWG sizes 22 thru 4/0. In accordance with MIL-C-25038.

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EXTRA FLEXIBLE CABLE . . .

High Temperature and Moisture Resistant Electrical Cable. Lewis "EXFLEX" Cable, single and multi-conductor, superior for circuits on hinged or pivoted parts. Resistant to abrasion and temperatures to 500° F.

* TEFLON is a Du Pont product

The LEWIS ENGINEERING CO.
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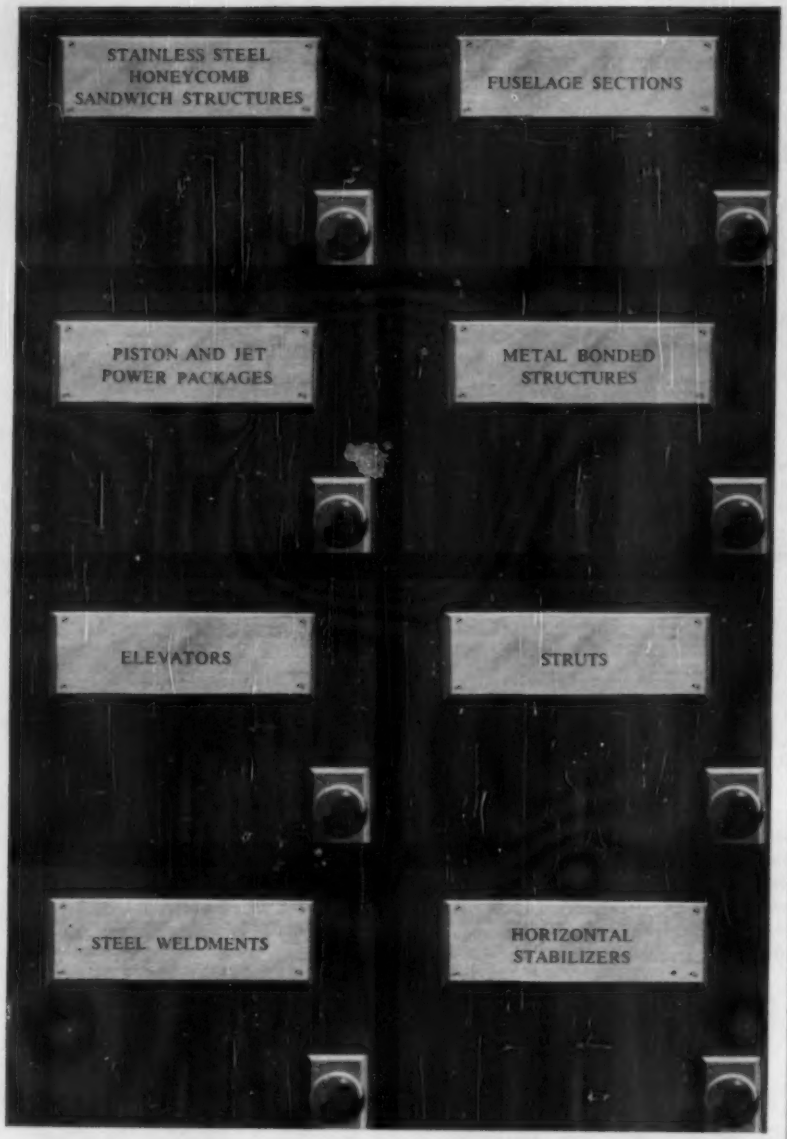

OPPORTUNITIES FOR DESIGN ENGINEERS

With over a quarter-billion backlog, *more than 50% commercial*, Rohr offers the skilled *aircraft engineer* the industry's utmost in long-range security and quick advancement opportunity in the fields of conventional and jet power packages and other major military and commercial aircraft components.

Forward resume to J. L. Hobel, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 6

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MAIN PLANT AND HEADQUARTERS: CHULA VISTA, CALIF.; PLANT RIVERSIDE, CALIF.; ASSEMBLY PLANTS: WINDER, GA.; AUBURN, WASH.

WHO'S WHERE

(*Continued from page 23*)

Changes

Adrian Paul Fioretti, manager, CJ-805 application engineering, Commercial Engine Operation, Aircraft Gas Turbine Division, General Electric Co., Cincinnati, Ohio. Also: **A. S. Johnson**, manager-facilities, Production Engine Department, and **M. R. Rowe**, manager-controls and accessories section, Jet Engine Department, GE's Aircraft Gas Turbine Division.

George W. Fenimore, assistant vice president, The Ramo-Wooldridge Corp., Los Angeles, Calif. **I. A. Binder**, the company's vice president-manufacturing, takes over Mr. Fenimore's former position as plant manager and will also be senior company representative of the Denver, Colo., operations.

Charles G. Habley, director-military relations, Ryan Aeronautical Co., San Diego, Calif.

John Vlad, Northeastern area manager, Grand Rapids Division of Lear, Inc., White Plains, N. Y.

Lockheed Aircraft Corp.'s Georgia Division, Marietta, Ga., has announced the following appointments: **James P. Lydon**, assistant manufacturing manager; **Fred N. Dickerman**, assistant chief engineer; **F. A. Cleveland**, chief advanced design engineer; **E. B. Gibson**, preliminary design division engineer.

Dr. George B. Simon, chief of engineering psychology, Link Aviation, Inc., Binghamton, N. Y.

Stanley W. Call, Dayton, Ohio representative, Nortronics Division of Northrop Aircraft, Inc., Hawthorne, Calif.

James W. Marshall, director-military contracts, Kaman Aircraft Corp., Bloomfield, Conn. Mr. Marshall continues as assistant vice president. Also: **Frederick L. Feinberg**, senior test pilot.

Edwin R. Wisner, director-newly established western sales office (Los Angeles, Calif.), The Budd Co., Philadelphia, Pa.

Ray McCurdy, technical sales representative, Marbon Chemical, division of Borg-Warner Corp., Gary, Ind.

Howard N. Sherman, sales manager, On Mark Couplings, Los Angeles, Calif.

Winfield Wagener, product manager-power tubes, Varian Associates, Palo Alto, Calif.

C. J. Thompson, district sales manager, Aeronautical and Instrument Division, Robertshaw-Fulton Controls Co., Anaheim, Calif.

Ralph P. Parker, manager-newly established government sales office, International Resistance Co., Philadelphia, Pa.

Walter J. Merck, national sales manager, Hitemp Wires, Inc., Westbury, N. Y.

John J. Engel, assistant director of public relations, National Airlines, Inc.

George M. Thom, sales manager, Safe Flight Instrument Corp., White Plains, N. Y.

Jack D. Mayfield, sales engineer, Electronic Engineering Company of California, Santa Ana, Calif.

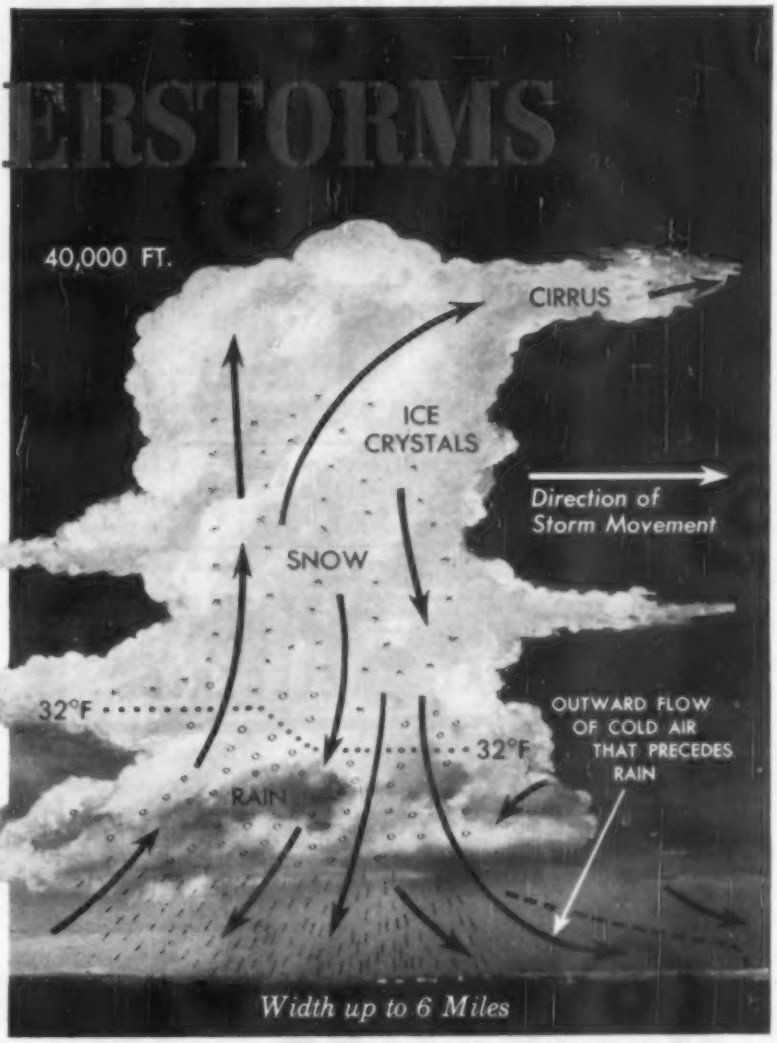
Joseph H. Fitzgerald, general manager, Ozark Air Lines, Inc.

FLY WEATHER-WISE

Mobil

These weather items prepared in consultation with the United States Weather Bureau

THUNDERSTORMS



SINCE most flyers avoid thunderstorms either visually or with radar, the only time they usually have to be reckoned with is near airport during take-offs or landings. Diagram at right indicates hazardous features of a mature thunderstorm.

Notice the wedge of rain-cooled air that pushes along the ground ahead of the storm. It is this rush of air that creates the greatest hazard to planes maneuvering in the vicinity. Very sudden wind-shifts may destroy lift momentarily and sudden drop in temperature can adversely affect engine performance. Cold downdrafts precede and accompany heavy rain and are usually followed by updrafts in rear portion of storm.

Maximum turbulence occurs in region of heavy rain where downdraft is closest to updraft. It is encountered between 12,000 and 20,000 ft. Maximum hail occurs between 10,000 and 15,000 ft., sometimes in clear air just outside cloud.

If forced to fly through storm, take following precautions: Prepare engine, de-icing equipment and instruments for changing conditions. Avoid turns and other maneuvers after penetration. Avoid over-controlling, ride with the drafts. Slow down to safe speed, but don't lower flaps to accomplish this. Don't try to adjust throttle for every change in airspeed indicator which is affected by brief pressure changes and rain.

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Top Flight Performance with Mobilgas Aircraft and Mobiloil Aero!

For top power . . . unsurpassed protection, rely on Mobilgas Aircraft and Mobiloil Aero. This famous fuel and quality lubricant have been designed to assure immediate throttle response and dependable performance under all weather conditions. Fly safely! Fly with Mobil!

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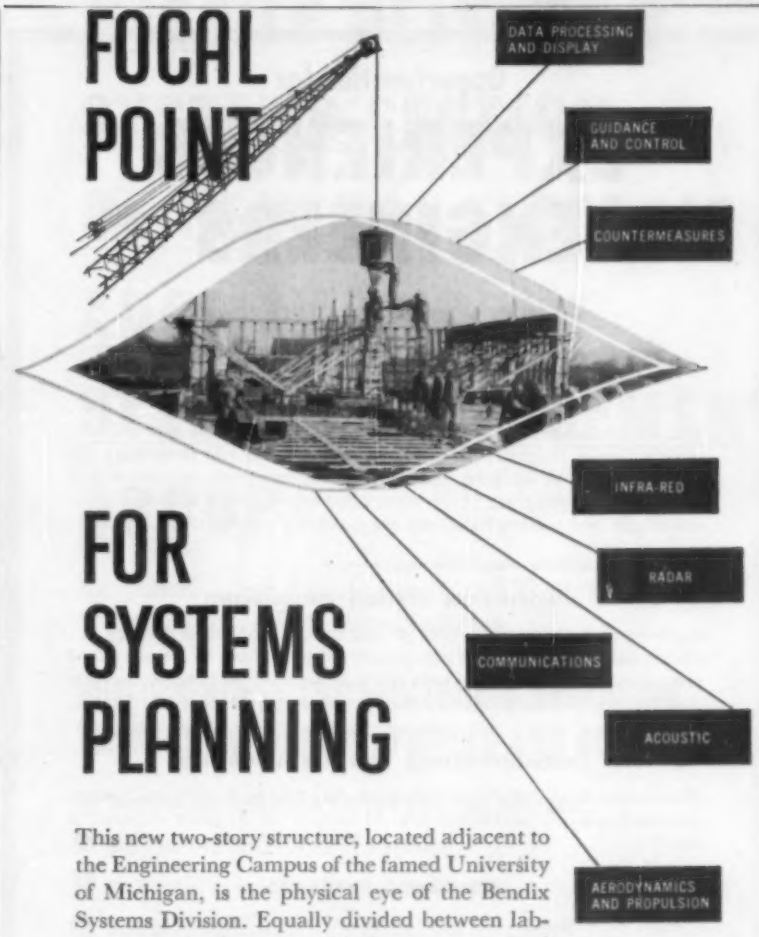

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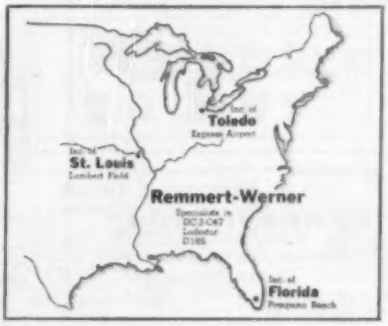

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Please write to: Mr. A. G. Stevenson, Engineering Personnel, North American Aviation, Los Angeles 45, California.

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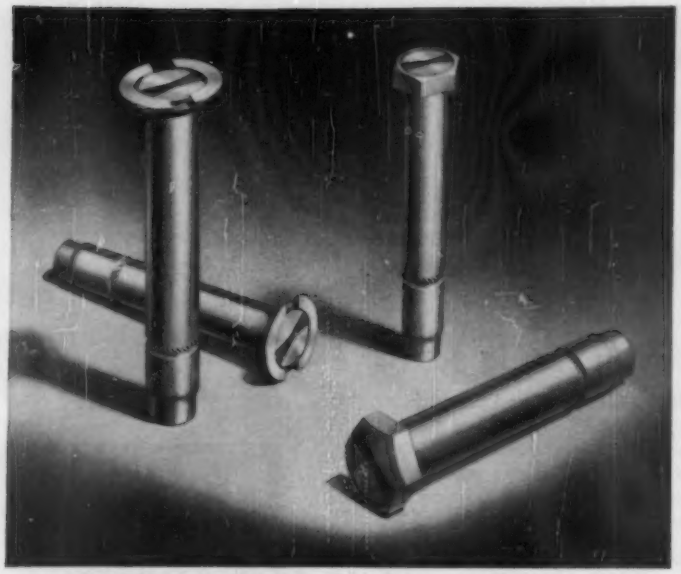

SPS Sleev-Lock blind fasteners conform with NAS 1059, can be removed without drilling and reused. Furnished in flush or hex head types, they come preassembled, can be driven at rates up to 35 a minute, cut fastener installation costs as much as 50%.

New SPS Sleev-Lock Removable Blind Fasteners Help Cut Airframe Assembly Costs

SPS Sleev-Lock blind fasteners are supplied preassembled. All you do is insert them in holes drilled in panels or bulkheads and drive, using an inexpensive adapter to a power driver. They can be installed by one man from one side of panel at rates up to 35 a minute, with resultant savings in installation costs running as high as 50%. In addition, they simplify inventory, prevent loss of parts, and speed handling.

Sleev-Lock fasteners can be removed as easily as they are installed, simply by reversing the driver. They can then be reused . . . something that is impossible with ordinary blind fasteners, which must be drilled out to be removed. Sleev-Lock fasteners thus extend the speed and economy of blind fastening to airframe structures that have to be dismantled periodically for service or repair.

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Sleev-Lock blind fasteners are available in flush head or hex head configurations in titanium, heat-resistant stainless, or aircraft alloy steel. Sizes from 3/16 through 1/4 in. diameter in 1/16 in. grip length increments. For more information, write Aircraft/Missiles Division, STANDARD PRESSED STEEL Co., Jenkintown 3, Pa.

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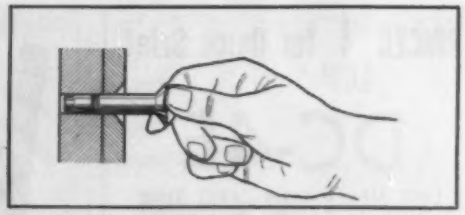
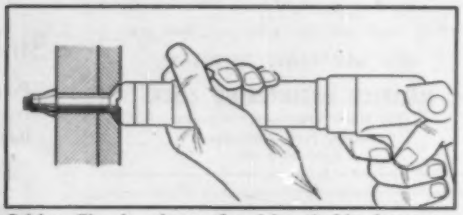
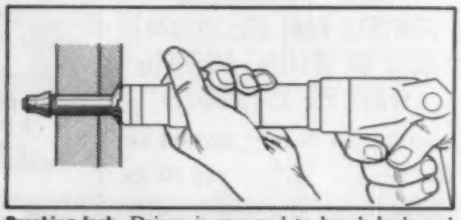


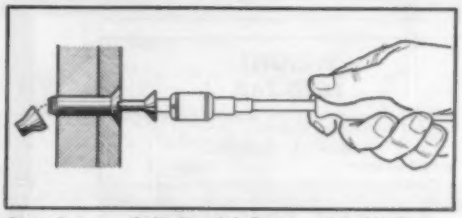
Inserting. Preassembled Sleev-Lock—consisting of sleeve, core bolt, and expansible nut—is inserted from one side of work. Unit can also be press fitted in undersize hole if desired.



Driving. Simple adapter for driver holds sleeve stationary, turns core bolt, drawing nut over end of sleeve and clamping work tight. Expanded portion of nut bears internally against knurled end of sleeve to resist loosening. Other end of nut has built-in locking feature, grips bolt securely.



Breaking lock. Driver is reversed to break lock and back off nut. Unlike an ordinary blind fastener, a Sleev-Lock does not have to be drilled out to be removed.



Removing core bolt. Special fixture grips Hi-Torque recess of core bolt for easy removal. Spent nut drops inside assembly—normally tolerable and preferable to collection of parts, chips and grit that results from drilling. Sleeve is then readily removed and, with core bolt, can be reused with new nut.

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LETTERS

Idea Buyer

Just a note to indicate hearty concurrence with Mr. Casad's remarks (AW May 19, p. 114) that shortage of engineering talent is only an illusion fostered by the average engineer's inability to sell his ideas to management, and to offer a workable solution to the problem he presents.

Several years ago AVIATION WEEK published a letter of mine (AW July 21, 1952, p. 98) which suggested management appoint an "idea buyer" to unearth and foster the development of the hidden, unused talent inherent in any engineering organization. As a "go-between" management and engineering, this man would be an enthusiastic "buyer" from engineering and "salesman" to management. Knowing management's desires, he could not only present engineers' ideas in their most acceptable form and at the best possible time, but he could alert engineers to some of those problems management considers most important and thus direct some of the engineers' "extracurricular" thinking along the lines of greatest value to the company.

The "idea buyer" plan, therefore, offers the following advantages:

1. It improves the engineering-management climate.
2. It provides good organizational control.
3. It unlocks valuable and previously unused talent.

The writer has found some of the most valuable solutions to important problems have come from entirely unexpected sources; only, however, when those sources were properly "clued-in" by an "idea buyer."

J. H. WILES
Cocoa Beach, Fla.

Direct Opposition

If Mr. Charles E. Casad (AW May 19, p. 114) would familiarize himself with the work of Mr. Johnson O'Conner's Human Engineering Laboratory he'd soon discover that those very aptitudes possessed by successful engineers are in direct opposition to those measurable traits found in successful salesmen and vice versa. Combinations of both sets of qualities are rarely scored by a single individual.

It's as difficult for a good engineer to "sell" as for a true salesman to understand the mechanics of his own automobile.

JOHN A. MAIN
Woodland Hills, Calif.

Joint Effort

I'm not able to credit the man who said "if you can't lick 'em, join 'em," but with respect to your May 19 editorial that comes to mind.

The problems are nebulous albeit human. The idea is that we have a geophysical cooperation year underway and we assertedly indicate a vehicle need for the various miniaturized recording sampling, etc., units available.

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Seems we might with the correct (and lucky) missionary convince the Russians to carry aloft our units and thus convey more effectively international good will.

This is the idea your editorial suggested. Perhaps you'd care to kick it around and plant a seed.

JOHN C. O'CONNOR
Capt. Pan American World Airways

IFR Filing

Mr. Dilts, in your June 23 issue (p. 94), states three aids to the "see and be seen" idea of flying. I wonder if he has considered these two facts:

1. There is no record of two aircraft having filed and flown IFR running into each other.
2. In each case of a mid-air collision one or both aircraft is/are VFR, thus making the accident possible.

No matter what color you paint them or what kinds of lights you use, with today's speeds you just cannot see the other aircraft in time.

If we all file and fly IFR above 10,000 ft. and on airways only, those who are VFR can run into those who are VFR.

I would like to add this to Mr. Dilts' statement ". . . each aircraft that the pilot can see is one that he won't hit."—if we all file, each aircraft that flies is one that he can't hit.

HOWARD S. MORTON
A Pan American Copilot
Oakdale, N. Y.

Specified by Law

An article in the March 10 issue of AVIATION WEEK (p. 28), regarding the flight engineer-pilot dispute, should be reviewed with reference to the statement about the origin of the flight engineer.

While this statement is technically correct in that it is quoting an AFL-CIO report, it is nonetheless spreading incorrect propaganda which began with the ALPA itself. I am referring to the statement that "the third crew member was established by government regulation in 1948 . . . with the advent of larger, faster, more complex aircraft."

I do not believe that you would knowingly malign a minority group even to the extent of quoting someone else, and I believe that perhaps you do not know what the origin of the flight engineer was.

First, let me say that I have record of the flight engineers dating back to 1931. That is the seniority date (as a flight engineer) of the earliest flight engineer, presently flying with Pan American Airways. A large number of flight engineers flying today were active as flight engineers before 1948, or even before 1940. The year 1948, in which the ALPA is taking credit for creating the flight engineer, is the year that the Civil Aeronautics Administration recognized that civil air-transport aircraft had become large and complicated to the extent that the flight engineer should be required by law; some airlines were not using flight engineers even though others had been for some time. Such a law was written, requiring a flight engineer on all large air transports, defining who the engineer was, and specifying what his duties would be. This law is in effect today.

To set the record straight—the third crew member is not specified by law—the flight engineer is. 1948 was not the year the flight engineer's position was established. We have record of flight engineers in 1931. The "third crew member" is a term drawn up by the ALPA in an effort to secure the flight engineer's position for the ALPA members. The definition of flight engineer in the Civil Air Regulations is clear and makes no mention of the "third crew member."

I intend to bring this error to the attention of the AFL-CIO committee, and I hope that you and they will resist further efforts of the ALPA to get you to help them malign the flight engineering profession and the Flight Engineers International Assn.

E. S. KUMP
Santa Clara, Calif.

Talos Development

The article on the Navy Talos which appeared on p. 25 of the June 2 issue of AVIATION WEEK was grossly misleading with regard to the role of the Applied Physics Laboratory, the Johns Hopkins University in the development of this potent anti-aircraft weapon.

The fact is that the aerodynamic configuration, engine, autopilot, guidance intelligence system, and basic airframe structural design were developed for the Bureau of Ordnance at the Applied Physics Laboratory and at associated university and industrial contractors under the direct technical control of the Applied Physics Laboratory.

The booster rocket was developed by the Allegany Ballistic Laboratory, a Navy Bureau of Ordnance facility operated by the Hercules Powder Co.

The role of the Bendix Aviation Corp. in the Talos program is primarily that of production engineering and manufacturing.

This writer suggests that your publication make the effort to get correct information before publishing articles which are ostensibly presented as factual.

H. E. RIORDAN
Silver Spring, Md.

(It was not AVIATION WEEK's intent to slight the contribution of the Applied Physics Laboratory in the development of Talos. However, the only reference to APL in the official Navy fact sheet released to the press is the following: "In 1944 the Navy asked the Applied Physics Laboratory of Johns Hopkins University to test the feasibility of the ramjet principle for missile purposes."—Ed.)

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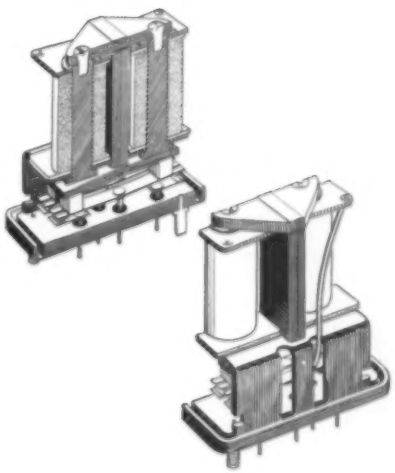

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